AMERICAN MACHINIST

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Universal Grinding Machine.

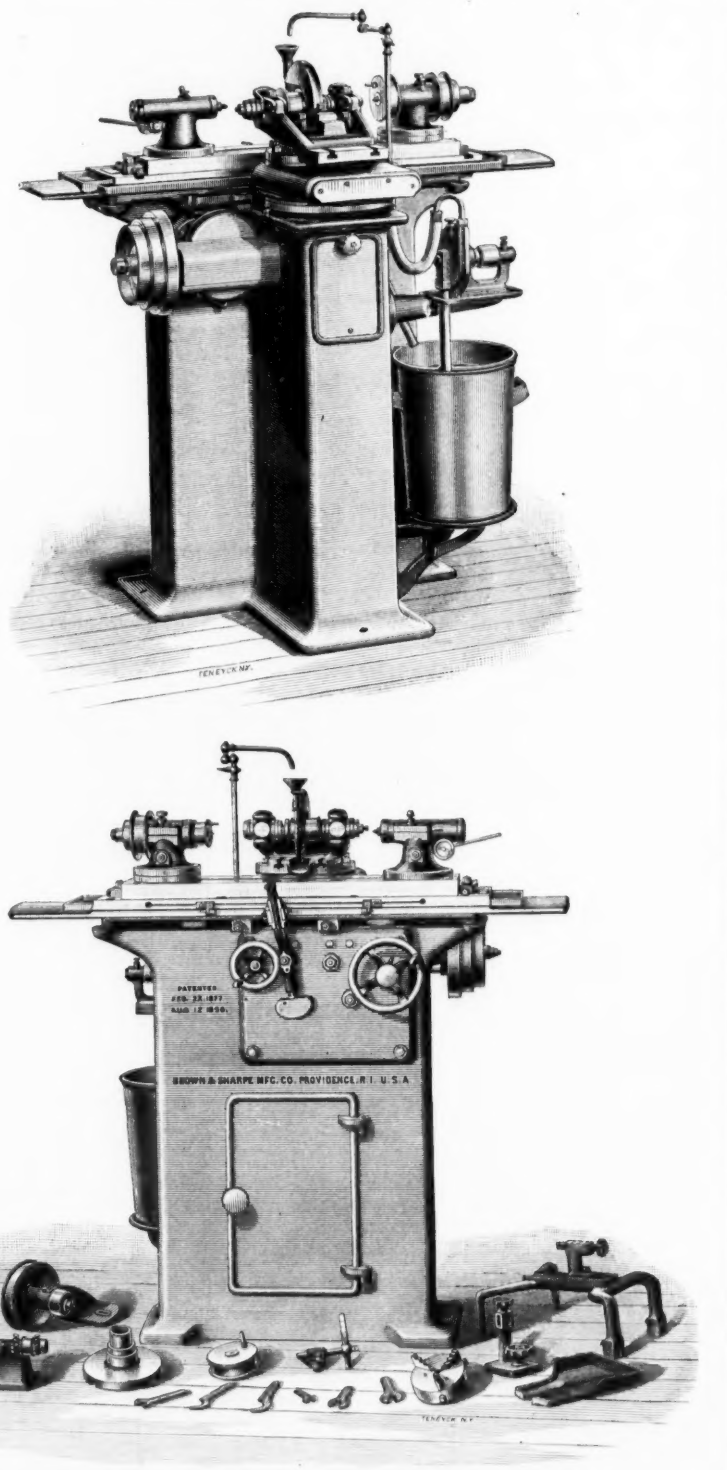
The illustrations on this and the succeeding page represent a newly designed grinding machine by the Brown & Sharpe Manufacturing Company, of Providence, R. I.

In its general features this machine resembles the one illustrated by us in our issue of Sept. 18, 1890, but is smaller, and differs from it in some of its details of construction. It is designated by the builders as the "No. 1 Universal Grinding Machine." Like the larger machine referred to above, it has a bed which is cast in one piece, which extends to the floor all around, and is arranged so that the weight of the machine rests upon three points only, thus effectually preventing any disturbance of perfect alignment by flexure, due to changes in the distribution of weight. The machine will swing work on the centers 8″ diameter and 16″ long. It has all the movements of the larger machine, the head swiveling to any angle, as does also the slide upon which the wheel is mounted, while the head and foot-stocks are mounted upon a swivel table by which they may be swung to an angle with the platen slide for grinding tapers, either upon centers or otherwise, this adjustment being indicated either in inches to the foot, or in degrees of arc, as may be desired, by a double set of graduations.

The feed is positively engaged by pushing on a knob, which is at the center of the large hand-wheel in front of the machine. The movement of the wheel slide to or from the work is indicated in thousandths of an inch by graduations on the smaller wheel. The motion of the table is automatically reversed by dogs, which do not strike directly against the reversing lever, but on the heads of screws, which can be adjusted in a sliding block which is fixed on the lever, the movement of these screws in the block giving a means of adjusting the point of reversal within a very small limit. This is found to be particularly advantageous where grinding is to be done up to a shoulder, as is also the feature by which the platen can at any time be run outside of the limits of movement fixed by the dogs, by simply moving the slide in which the contact screws are placed, upwards on the lever, so that the dogs pass by without coming into contact with them. This gives facilities for the measurement or examination of work without disturbing the adjustment of the dogs, so that when grinding is resumed the platen will reverse at exactly the same points as before, simply by pushing down the slide on the lever, so that the dogs again come into contact with the screws.

At Fig. 3 (page 2) is shown a side view of the wheel platen, this cut also showing the relative positions of the most important parts of the machine. The rest shown is used only on work, which, by reason of its small diameter in proportion to length, or for some other reason, is liable to spring. This rest is secured to the bed of the machine, so that it does not move with the platen, but remains opposite the wheel. Another rest is also furnished, however, which is attached to the table by the same T slot used for attaching the head and foot-stocks, this, of course, moving with the work. In both rests a block of hard wood is held rigidly against the work, to prevent vibration.

The same arrangement of bearings for the wheel spindle is used on this machine as for the larger one, they being so made that they are self-adjusting, so far as alignment is concerned, and the spindle with its boxes can be removed and replaced or reversed without disturbing their adjustment. These boxes are made of phosphor bronze, which



UNIVERSAL GRINDING MACHINE—REAR AND FRONT VIEWS.

has been found to be best for this purpose, as it admits of the spindle being run in actual metallic contact when necessary, as it sometimes is for work of this character.

When internal grinding is to be done, the wheel platen is turned round to the position shown by Fig. 4, where, in place of the wheel stand, is seen a speed counter at the back, while in front is the internal grinding fixture illustrated and described by us in our issue of Dec. 11, 1890.

The construction of the head-stock is shown by Figs. 5 and 6. It is secured to the swivel table by a T bolt which extends up within the head, and is drawn up by a taper bolt as shown. The head swings upon the base to any desired angle, indicated in degrees by the graduations. The bearing of the spindle is formed as shown, by a single plain sleeve of phosphor bronze, which is split open at the back, while the barrel or cylindrical portion of the head itself is split open opposite to this, or in front. By adjusting the screws *a*, the box may be tightened on the spindle. The screws *b* at the back are tapped into the head, and have conical ends as shown, which fit into conical holes formed in the phosphor bronze bush along the line of the opening, these screws serving to hold the bush open, so that they must be slacked out before the box can be tightened. Thus the box is made practically a solid one. The driving pulley is carried over the bearing in the manner shown, to prevent undue wear, and a screw at the top can be tightened down, to prevent rotation of the spindle when work is being done on dead centers.

The arrangement of the pulley, with its bearings for this dead center grinding, is also shown by this cut.

The foot-stock is shown by Figs. 7 and 8. It is secured to the swivel table in the same manner as the head-stock, and the spindle is moved forward to the work by the action of a spiral spring, so that as the work expands by the heat generated in grinding, the center can yield endwise, and prevent undue pressure and cutting. The lever below serves to withdraw the center from the work, and it can be clamped so as to hold the spindle in any desired position when necessary, by means of the hand nut shown. A hole extends entirely through each spindle, and there are caps which effectually exclude dust.

Provision is made for using a liberal supply of water, there being a centrifugal pump, with a system of conduits, by which all water is caught and returned, to be again used after being allowed to deposit abraded material.

The angular adjustment of the swivel table is sufficient to provide for grinding tapers up to 1½″ to the foot, or 3½° in angular measure, while, of course, any desired angle or taper may be obtained by other means already referred to. The wheel slide has a movement of 4″. The wheel stand will take a wheel 7″ diameter, ¼″ thick, with a 2″-hole in the center. Internal grinding fixtures of various sizes may be used with the machine, but the one usually sent with it will grind holes 5″ deep, and from ¾″ diameter upwards, and is adapted to use wheels up to 1″ diameter. All necessary overhead works accompany the machine, and there is provision for varying the speed of either the wheel or the work. The work is started or stopped independently of the wheel, and when the shipper is moved for this purpose, a brake is automatically applied, which stops it without loss of time.

The main countershaft is driven by a 3″-belt running on 8″ pulleys, its speed being about 280 revolutions per minute. All the counters run in self-adjusting and self-oiling boxes.

The floor space required for the machine, measuring over all projections and points of travel of the various parts, is 36x69″, and the weight of the machine boxed ready for shipment is about 2,600 pounds.

We have received from the Meriden Machine Tool Company, of Meriden, Conn., a number of samples of work that have been done on the forming lathe which they build, and which we illustrated and described in our issue of November 27, '90. The pieces include the tops of mustard and other condiment bottles, such as are used on the table, made of "white metal," some of them plated just as they came from the lathe and others unplated, showing the condition in which the tool leaves them. There are also a number of casket trimmings made of brass, and a brass nut faced on one side and chamfered on both sides, all these pieces being finished at one operation. Accompanying the pieces is a statement that from 4,000 to 5,000

of the white metal ones, according to size, can be easily finished in one day on the lathe, which statement, together with the quality of the work, which is first-class, speaks volumes for the efficiency of the machine, and goes far towards explaining why such work can be done so marvelously cheap in this country.

Trading Morality of the Japanese.

Considerable discussion, by the way, has ensued in regard to the lack of commercial morals shown amongst Japanese merchants. A letter in the *Japan Mail*, signed "An Import Merchant of Twenty-five Years' Experience in Japan," concludes as follows: "Finally, it resolves itself into this, in my opinion, and I think it is that of the merchants here generally, that as trade is now carried on at the treaty ports, all contracts entered into by Japanese and foreigners are entirely one-sided. If the former sees a profit he takes it, but if there is a loss the latter has to bear it, perhaps not by an actual breach of contract on the part of the Japanese, but by their delay in taking delivery of the goods, and loss of interest, etc. Goods cost roughly one per cent. per month to hold, calculating interest, go-down charges, etc., so it will be seen if they are left undelivered for, say, three months (a not at all unusual time), there is actually a loss on them; for as things are now it is very rarely that two to three per cent. profit is seen on a transaction when it is entered into. I have not in any way exaggerated the present position of affairs at the treaty ports, and have written this to show how foreigners look upon the way in which the native dealers keep their so-called contracts, and I shall be glad if it may serve to show them it will be to their advantage to deal more honestly with foreigners—or, in other words, to do as they would be done by. It would be interesting to hear the dealers' own account of such transactions as I have mentioned above, and what excuses they can give for their continued breach of faith in keeping contracts. One of the chief causes of England's great commercial success has been the integrity of her merchants, and if the Japanese have any wish for their country to attain a corresponding position, the first thing they must do is to keep their contracts honorably, whether written or verbal, and not, as at present (with foreigners at least), to take every opportunity of getting out of them when affairs have taken a turn they did not anticipate at the time of entering into them. They would do well to remember one of the sayings of Confucius, which runs somewhat as follows: 'A man who enters into a speculation and sees only the profit and not the loss is like unto a fish which sees only the bait and not the hook.'"—*The Engineer and Iron Trades Advertiser.*

Electric Supply Stations at Liverpool.

At a recent meeting of the Liverpool Engineering Society, Mr. A. Bromley Holmes, M. I. C. E., read a paper "On the Liverpool Electric Supply Stations." From this paper we gather that the first station of the Liverpool Electric Supply Company was built in 1883, and the latest began working in October, 1890, there being now three stations, supplying current to 11,750 sixteen candle-power lamps, and capable of being extended so as to supply 37,000 lamps. Belt-driven dynamos were at first employed, but these have been replaced by sets of direct-driven dynamos mounted on the same bed-plates as their engines. The plant is worked on the direct continuous current system, the potential being 110 volts only, and the mains being laid in simple parallel. Steam to the engines is supplied from ten steel boilers 28 feet long by 7 feet 6 inches in diameter, all of which are fitted with mechanical stokers. The working pressure is 110 pounds to 120 pounds per square inch. The engines are of Willans' central valve compound high-speed type, 10 of them of 180 indicated horse-power, and the remaining three of 60 indicated horse-power. The dynamos driven by the small engines are capable of supplying a current of 300 amperes, at from 110 to 140 volts when running at 450 to 500 revolutions per minute. The larger engines can supply a current of 900 amperes at 115 to 135 volts when running at 375 revolutions per minute. In addition to the above plant there are a number of secondary batteries, with a capacity of 1,700 ampere hours. The distributing mains are all underground. The conductors are of stranded wire, with a conductivity of 98 per cent. The largest mains have a cross-section of 1.57 square inches. They are covered with two layers of yarn steeped in bitumen and encased in a leaden pipe, which in turn is protected from injury by a covering of rough yarn steeped in tar. The mains are laid in cast-iron troughs ¼ inch, and about 6 feet long. When the troughs are placed in position about ¼ inch of refined bitumen is run in, and before hardening, spacing bridges of wood are placed in it about 18 inches apart. The cables are laid on these bridges, which hold them clear of each other, and the sides of the trough. The cables having been placed in position, the troughs are filled up with bitumen to within ½ inch of the top, completely covering the cables, the remainder of the trough is then filled with Portland cement concrete. In all there are ten miles of feeding mains, 9 of distributing, and 1½ miles of service mains.—*Engineering* [London].

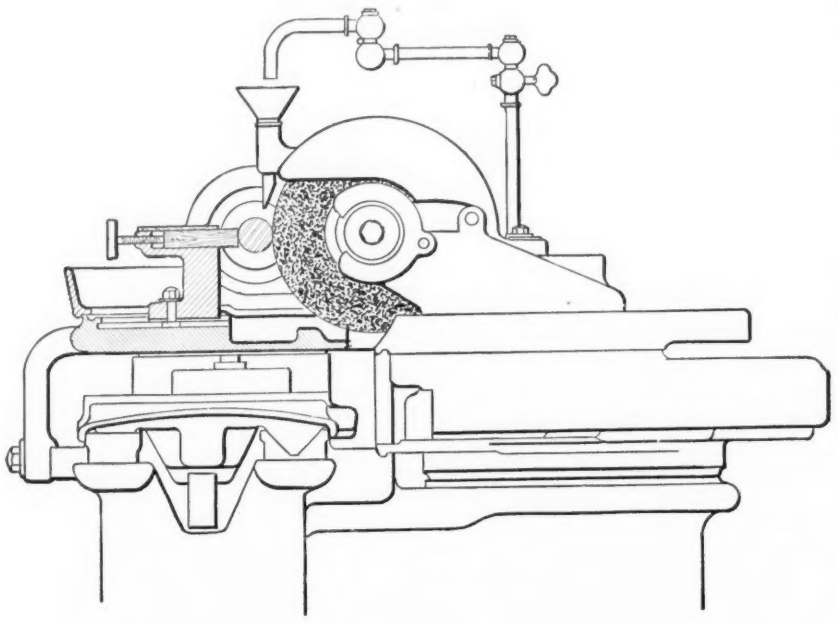


Fig. 3.

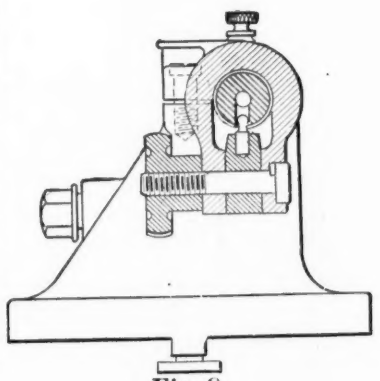


Fig. 8.

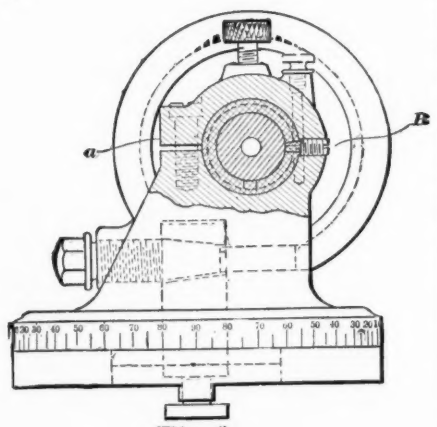


Fig. 6.

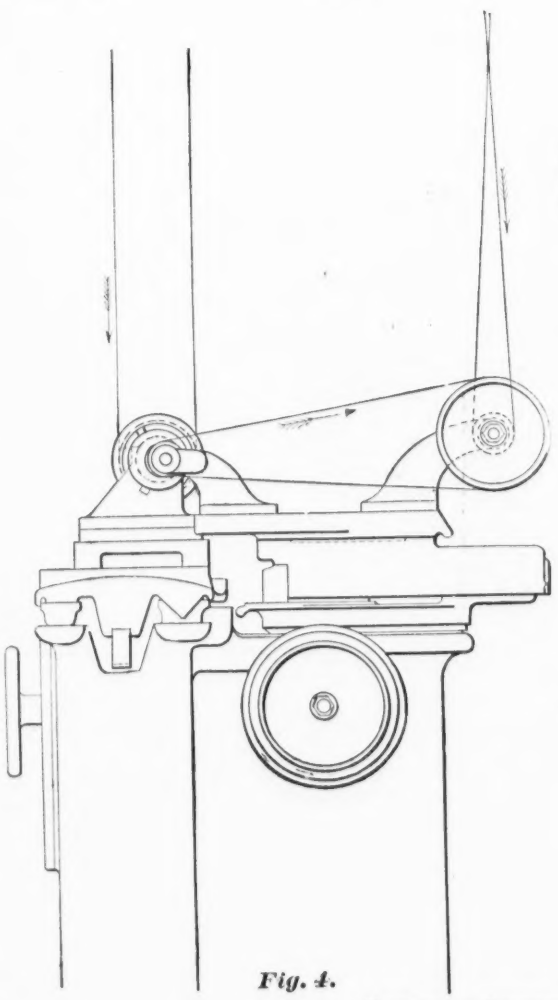


Fig. 4.

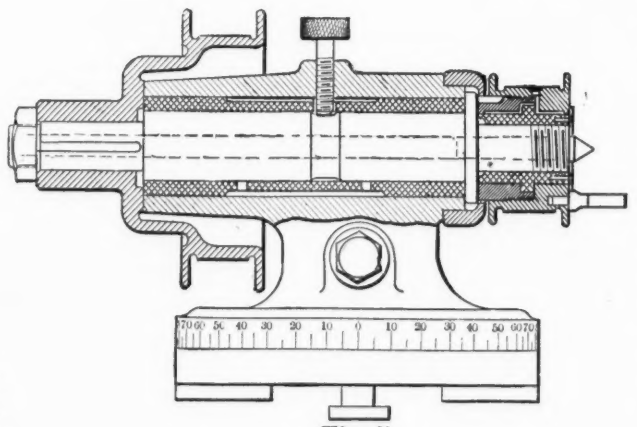


Fig. 5.

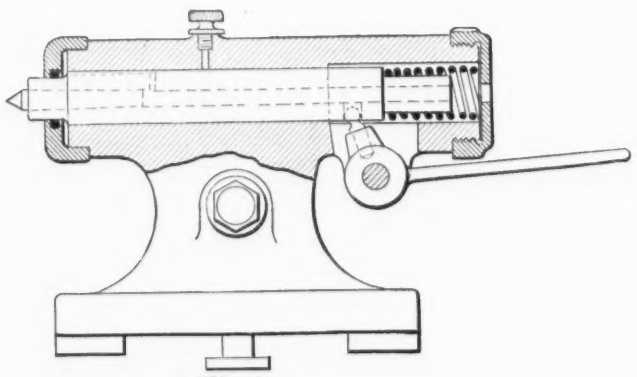


Fig. 7.

UNIVERSAL GRINDING MACHINE.—SEE PAGE 1.

Shop Incidents.

BY BELL CRANK.

An incident occurred in a shop where I once worked, that was a very good example of the value of knowledge and a cool head. The engine that run the shop was being repaired, and to do this a part of the line shaft was being driven by a small portable upright engine and boiler, set on the shop floor, and belted to a pulley on the line shaft. The engine was governed by a common fly-ball throttling governor driven by a belt. One day while the engineer was not close by, the governor belt came off, and the engine at once got up to a high speed, and was beginning to dance on the floor before he discovered it. This so excited him that it was some moments before he got hold of the throttle wheel, and commenced to shut it off. The throttle was wide open, and had a long ways to screw up, and while the engineer was dancing a lmost as lively as the engine, the master mechanic came walking up to the engine, and taking hold of the governor balls, lifted them up enough to shut off the steam, and held them there until the engine stopped.

A friend, now well up in the business, related to me an incident of his apprentice days, which well illustrates the importance of small things. In the early part of his apprenticeship he was put at work on what had been a small foot lathe, but was now to be driven in the usual way from an overhead shaft. It set on and was bolted by the feet to a square, thin stone slab, which rested on the floor, and was heavy enough to keep the lathe in position. He was given a new belt and a lacer, and told to put the belt on and get the lathe ready to run. He laced the belt as best he knew, but left the ends of the lacing hanging loose a few inches. It had run but a short time, when, upon trying to shift it for another speed, it got off the pulley above, the lacing ends caught on a set-screw and commenced to wind up the belt. Imagine his dismay at seeing the lathe, stone slab and all, suddenly rise from the floor and go to the ceiling, and having gone as far as possible, the belt gave way and it came crashing down, breaking the stone to fragments, and wrecking the lathe badly. To add to his misery the foreman came around and scolded him for it.

Wooden Toothed Gear Wheel.

As is well known, the severe service to which street railway motors are subjected is very trying on the gear wheels, as the high speed at which they run soon wears the teeth, creating back-lash, and the result is a very noisy piece of machinery. The purpose for which this wheel is designed is to prevent the noise, and also make a wheel that with ordinary care will wear out several iron gears. Several kinds of material are used for making the teeth of these wheels, but applewood in most situations gives the best results, and is generally used.

The body of these gears being made of cast-iron, and subjected to no wear at all, the gears will last indefinitely with the occasional renewal of the teeth, things being so arranged that this renewal is a very simple and easy matter.

The method of construction of these wheels is as follows:

The core is cast in one solid piece, and bored and turned to the diameter the wheel would be at the bottom of the teeth. It is then placed in a Gould & Eberhardt automatic gear cutting machine, and the spaces for teeth milled in the periphery, after which it is taken to the wood workers, and the teeth driven into the core with white lead. The wheel is then placed in the lathe, and turned to the proper size for the finished wheel, after which the side plates as shown in the cut are placed in position, and drawn up tight. Then the wheel, being ready to have the teeth formed, is placed on the automatic machine a second time, and the machine being speeded high, and by using a fly cutter, the teeth are formed to finished shape.

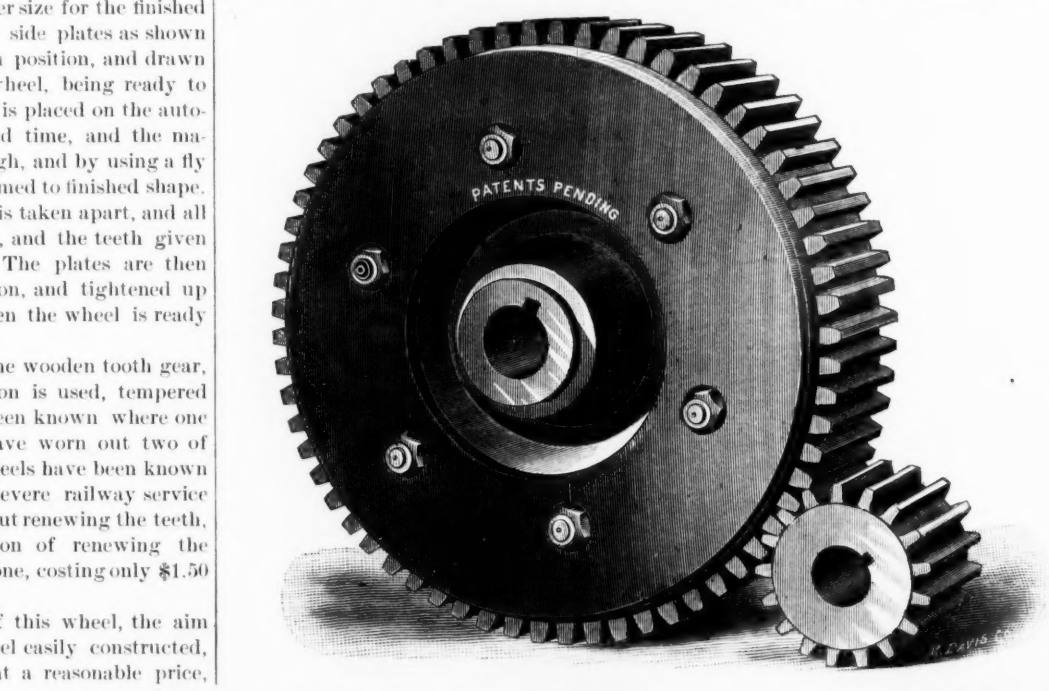
After this the wheel is taken apart, and all chips and dirt removed, and the teeth given a coat of boiled oil. The plates are then again placed in position, and tightened up with lock washers, when the wheel is ready for service.

In connection with the wooden tooth gear, a tempered steel pinion is used, tempered hard, and cases have been known where one set of wooden teeth have worn out two of these pinions. The wheels have been known to wear in the most severe railway service for eight months without renewing the teeth, and then the operation of renewing the teeth is a very simple one, costing only $1.50 for a new set.

In the production of this wheel, the aim has been to get a wheel easily constructed, which could be sold at a reasonable price, and could be maintained by an ordinary carpenter, as a former is furnished when required, which enables any carpenter to refill a wheel at a very small cost. While in the operation of renewing the teeth the wheel may be left in position on the motor, as all that is necessary to remove the teeth is to take off the side plates, when they can be driven out without trouble.

These wheels are in operation on several of the prominent roads of the United States, among them being the Erie Electric Motor Co., of Erie, Pa.; the Atlantic City Railway, of Atlantic City, N. J.; the Federal St. & Pleasant Valley Railway of Allegheny, and the Second Avenue Passenger Railway of Pittsburgh.

These wheels have been found by a series of experiments to be much cheaper to maintain than the ordinary form of gearing now in use, the only parts that wear being the teeth, as the core, being made of cast-iron, will wear indefinitely. They are made by R. D. Nuttall & Co., Allegheny, Pa.



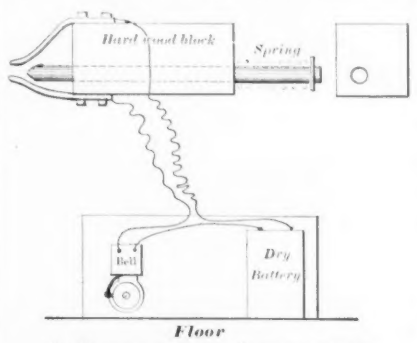
WOODEN TOOTHED GEAR WHEEL.

A Machine Shop Annunciator.

In the machine shop of the Meriden Machine Tool Co., Meriden, Conn., can be seen a device for the purpose of announcing when a cut being taken on any machine tool has nearly reached the end, so that attention is required. It is the scheme of Mr. W. L. Cheney, and is illustrated by the accompanying sketch, which is not to scale, but serves to show the idea.

It consists essentially of a hard wood block with a hole through it lengthwise near one corner, for a ⅛ round brass rod, which passes entirely through as shown, is pointed at one end, and has a pin put through it back from the point a little distance, for a stop. The other end of the rod extends out from the block, and is provided with a washer, behind which is a common spiral spring which keeps it normally in the position shown. At each side of the pointed end of the rod there is a strip of brass or German silver bent as shown, so that if the rod be pushed in the direction of the arrow it will come into contact with both of them. To these strips there are wires attached which are long enough to reach to the floor from any position in which the block is liable to be placed. These wires enter a box in which is a dry battery and a common jingle bell, the front of the box being covered over with wire netting to let out the sound of the bell and keep out the chips. A dry battery is used, for the reason that the box is liable to be tipped over occasionally, and when it is, the results are less disastrous than would be the case with a wet battery.

Now the hard wood block may be clamped to the cross-rail of a planer, or to the bed of a lathe, in such a way that, as the end of the cut approaches, the head or carriage pushes in the brass rod until it comes into contact with the bent strips, when, the circuit being complete, the bell rings. Where the device is used on a lathe, planer, milling machine or other tool where its position is horizontal,



A MACHINE SHOP ANNUNCIATOR.

the spring and washer are not needed, but they are put on so that it can be placed vertically under the spindle of a drill press when desired. Several of them are in use in the shop, and are found to be very useful.

A Good Showing for Electricity.

Chief Inspector McDevitt, of Philadelphia, makes the following statement in his report to the underwriters:

"There are over 5,000 buildings in Philadelphia wherein electric currents are used for light and power purposes. Of this number, 287 buildings (seven of which are dwellings) have their own apparatus, the latter varying in size from a 20-light to one of 4,000 lights. The number of lights furnished by these private plants aggregates 80,258 incandescent and 3,325 arc lights. One retail store contains 482 arc lights. There are fifteen public stations distributing electric currents to all sections of the city, furnishing thousands of lights and power to dwellings, churches and other classes of buildings. The number of lights supplied by these respective stations varies from the small station furnishing 2,000, to the Edison, which furnishes over 40,000 incandescent lights, and current for a large number of motors. The electric motors in use are of a capacity ranging from one-eighth to thirty horse-power (being used to a great extent as a substitute for laborious hand or foot-power in dwellings and small workshops), and are being rapidly introduced as a more ready motor in place of steam and hydraulic power in propelling machinery. No insurance loss occurred in any building in our city during the past year from fire where the cause could be in any way attributed to the electric wires."

In a communication to the French Paysical Society, M. Cailletet has described a method of connecting a metal tube or stop-cock to a vessel of glass or porcelain, so that the joint shall be tight even under high pressures. The process is simple, and consists in first coating the glass or porcelain vessel with a very thin layer of platinum at the part where the connection is to be made. This may be done by painting the glass, after slightly warming it, with a neutralized solution of platinic chloride mixed with the essential oil of camomile. The layer of oil and platinic chloride is then slowly heated till the last traces of oil have been expelled, and the temperature is then raised to a dark red heat. The chloride is thus reduced, and the platinum deposited as a bright metallic mirror on the surface of the glass. On this layer of platinum a second layer of copper is deposited by electrolysis, and the metal stop-cock or tube can then be soldered by means of tin to this copper ring. M. Cailletet states that he has found these joints to remain tight under a pressure of 300 atmospheres.

Our contemporary, *Industry*, in referring to a large engine recently completed on the Pacific coast, says that "the main bearings are water-jacketed, a very desirable feature in any large engine." We doubt the desirability of this feature in either large or small engines running under ordinary conditions. Where bearings are large enough for the load put upon them and are kept in good condition, there will be no heating. When either of these conditions cannot be maintained, then a water-jacket may be well enough, but in most instances these conditions can be maintained, and when they can it is much better to do so than to depend upon water-jackets to carry off heat that ought not to be generated. All the heat that is carried from a bearing by the water circulating through a water-jacket is lost heat and lost work, and the water jacket may easily become simply a means of preventing its being known that this loss is going on. Heat in a bearing is evidence that something is wrong, and it is far better to remove the causes of the generation of the heat than to simply carry it off and keep on generating it.

A press dispatch from Watertown, N. Y., says: "The Watertown Steam Engine Company has declared a 2½ per cent. semi-annual dividend to its employes, except apprentices and office men. The company announces that, for the current year, it will pay semi-annual dividends to its employes on the amount of wages they receive at the same rate as the dividends paid to stockholders."

Electric Register and Signaling System.

Amongst the many uses to which electricity has been put within the past few years, in none, perhaps, has it shown itself more competent to render valuable service to the manufacturer than in the recording of the movements of night watchmen in making their rounds about the building at night, it having in many large establishments entirely superseded the devices formerly employed for this purpose. It has also been used for a system of signal boxes, from any one of which the engine of the factory may be shut down without loss of time when it becomes important to do so, and, also, for a system of shop fire alarms.

We herewith illustrate a system of electric signaling and registering which combines within itself all these functions, and performs them all in a manner which seems to leave nothing to be desired.

We will first describe its action as a watchman's time detector. At Fig. 1 is seen the registering apparatus, which consists essentially of a fine clock movement which is connected with printing rolls in such a manner that when anything whatever is done to any of the signal boxes about the building, the action, whether it be a legitimate and proper one, or a case of tampering, is recorded by printing upon a strip of paper the number of the signal box, and the time at which the action occurred, within one minute of time. The tape, a section of which is shown at Fig. 2, is neither moved through the register nor actually printed directly by the clock movement, but the power for this is furnished by weights which are attached to cords passing down into a cabinet (not shown), upon which the register stands. Thus the timekeeping qualities of the clock are in no way interfered with, and the further important advantage is secured, that, should the clock movement for any reason stop, the strip will be fed through and printed with the number of the boxes, and the character of the signal sent in from them, just the same as though the clock were running, the only thing omitted being the time. The registering apparatus is also covered with a glass case, which prevents access of dust and meddlers, and may be placed in any favorable location—preferably the superintendent's office—as it is very attractive in appearance.

The system is adapted to use any desired number of signal boxes up to 90 without special arrangement, and no signal from any box can interfere with that from any other box. At Fig. 2 the record shown shows that station 43 (the two outside figures giving the number of the box) was reached by the watchman at 9:48 o'clock; station 44 at 9:50, and station 45 at 9:51. No blank spaces are left in the strip, as it is fed through the register only when a signal of some kind is given, and enough paper is carried in the machine to last about one month under ordinary circumstances. It is printed in ink which will copy, so that, if desired, the strip which has been printed during the day or night may be torn off and copied into a book kept for the purpose, in the same manner as letters are copied. The registering mechanism needs no further attention, except to wind the clock once a week.

At Fig. 3 is shown the apparatus which is placed in the engine-room when the system includes the automatic stop for the engine. In almost every shop or factory there are places at which there is danger of something occurring which will make it very important to stop the engine as quickly as possible. The machinery may become disarranged, a belt come off its pulley, or a workman may be caught in the machinery in such a way as to make the saving of his life depend upon the prompt stopping of the engine. At all such localities there are placed signal boxes like the one shown in Fig. 3, on the wall just above the hydraulic valve mechanism, and having a small crank handle outside, and figures from 1 to 4. These boxes are of iron, dust-proof, and over each one is posted a card giving plain directions for giving signals, as shown by Fig. 4. In giving a signal it is only necessary to place the handle over the number corresponding to the signal it is desired to give, and release it; the handle then automatically returns to its normal position, and in doing so gives the corresponding signal. The number of the station from which this signal comes, and the time, is then printed on the strip of paper in the register, and the number of repetitions of this printing indicates the character of the signal, as will be hereafter explained. Simultaneously the number of the station and the character of the signal are shown by the figures which appear at the openings of the "automatic recorder" shown above the signal box on the wall of the engine-room,

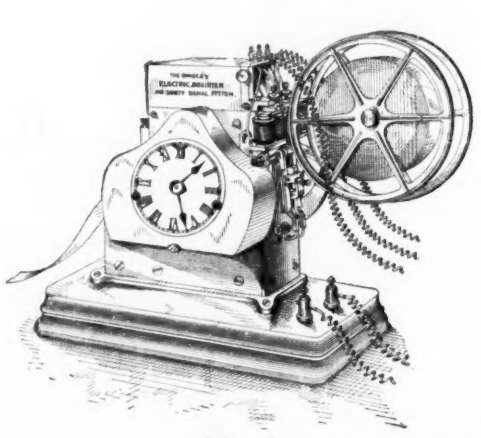


Fig. 1.

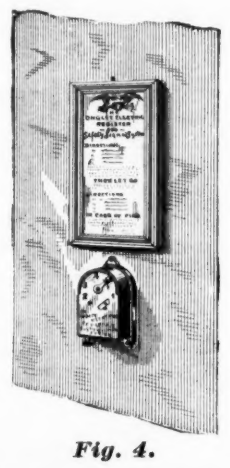


Fig. 4.

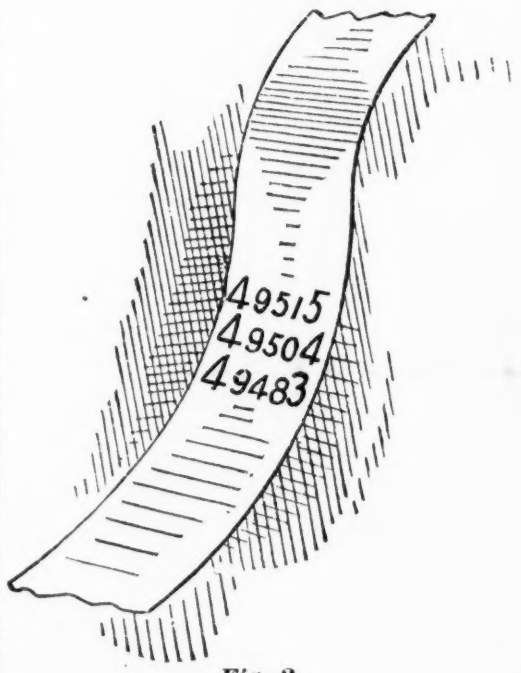


Fig. 2.

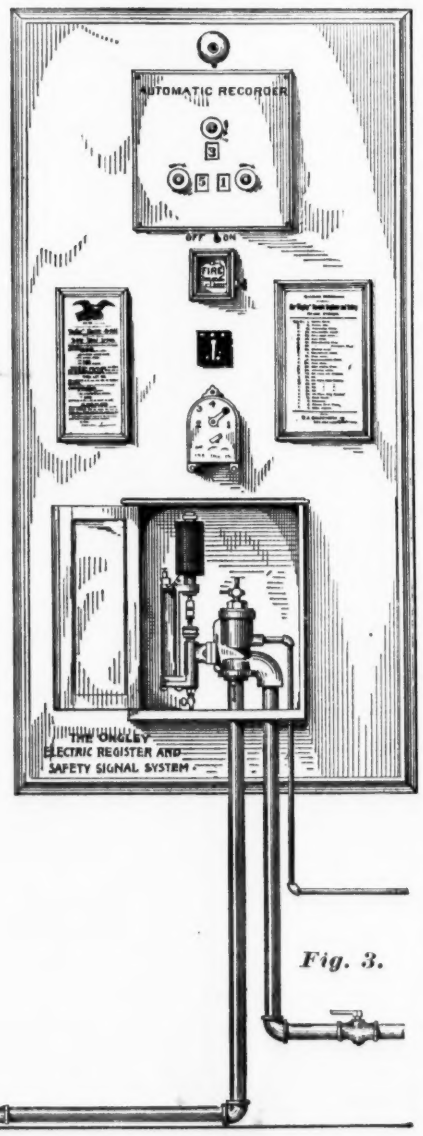


Fig. 3.

and a bell is set ringing, which calls the attention of the engineer, and keeps ringing until he goes to the recorder, and, by turning the knobs shown, restores the dials to their zero positions. This recorder is switched out of the circuit at night, or when the machinery is not running, and signals to the engine-room are not needed.

Below the signal box in the engine-room is seen a case with the door open, showing part of the mechanism by which the engine is shut down automatically from any station, upon the proper signal being given. This part of the mechanism consists of an electric hydraulic valve of the same design that has been for some time used on elevators, and is known to be reliable. After being used, it automatically returns to its normal position, and is immediately ready for use again. Connected with it by the pipe shown is a hydraulic cylinder which is usually placed about as shown on the floor under the throttle valve stem. The piston in this cylinder may be connected directly to a rack as shown; or there may be intermediate gears, as circumstances call for. Ordinarily there is no pressure either side of the piston, and the valve is entirely free to be handled by the engineer, the same as though nothing were attached to it. Upon the action of the hydraulic valve spoken of, however, water pressure is admitted below the piston, and the valve is immediately closed, and the engine comes to a standstill. When this is done, the signals are set and the bell rung, as already described, so that the engineer, his attention having been called, goes to the engine, and, with his foot, opens the three-way cock shown in the pipe at the floor, allowing the water to pass to the waste pipe, thus placing the valve again under his control. When such a signal is given, the register prints upon the strip of paper the number of the station from which the signal comes, the hour and minute, and repeats this printing three times, making four entries in all. The number of times the printing is done on the slip thus corresponds to the number (4) which indicates the character of the signal, *i. e.*, "engine stop," so that at any time the strip will show the exact minute at which the engine was shut down and the station from which the signal was turned in. Water for the operating cylinder may be taken from the city water service, or from a tank placed at the top of the building and by properly proportioning the size of pipe used, or the opening of the valve in the pipe, the throttle is moved very steadily and uniformly until closed.

After releasing the water from the cylinder, as explained above, the engineer is then ready to receive and act upon signals sent from the station indicating "start slow," or "full speed." When the handle on the signal box is placed over the number 1, which signifies "start slow," the bell is rung in the engine-room as before, the figure 1 is displayed on the automatic recorder, by which the engineer knows what is wanted, while at the same time the number of the station, with the hour and minute, is printed *once* on the strip, this single printing showing at what hour and minute the engine was started, and from what station. When the engine is to be started full speed, the handle of the signal box is put over the figure 2, the corresponding number appearing in the engine-room, accompanying the ringing of the bell, while the station and time are indicated by the printing on the strip as before, except that these are in this instance printed *twice*, which corresponds to the number of the signal (2), thus showing the hour and minute at which the engine was started full speed, and the number of the station from which the signal came.

In each case the building is so wired that there is a continuous circuit, starting at the engine-room and returning to it, and the engineer may use the engine-room signal box twice a day for shutting down if he chooses, and every time he does so he demonstrates that every box, and, in fact, the entire circuit, is in working order. When he thus closes the throttle, it is easy for him to walk to the engine, and by opening the three-way cock with his foot, release the valve and get steam again before the engine comes to a stop, so that the actual stopping can be done by the use of the starting bar, or by hand with the throttle, if desired.

Figure 1 on the boxes is used at night by the watchman to register his movements, and figure 3 at all times, day or night, means fire. When this signal is turned in, the word fire appears on the board in the engine room, as shown, or at any other place that may be desired, together with the number of the box from which the signal comes, while the register prints the number of the box and the time, *three* times on the strip. This signal is also usually arranged to connect with some special signal, such as a large bell or whistle, or with the city fire-alarm system. This signal may also be arranged so that, when it is given, an extra valve opens the throttle valve of a steam pump for supplying water. This alarm, when given, cannot be stopped by the person giving it, but continues, leaving him free to make any other necessary preparations for fighting the fire.

A twelve-cell open-circuit battery furnishes ample current for all this, and every provision seems to have been made for the reliability of the plant, and for preventing any one or more of its functions from interfering in any way with any other one.

The apparatus can of course be arranged to perform any one or two of these functions when desired, *i. e.*, it may be simply for the watchman, or for shutting down the engine only, or for fire alarm only, and the other features may be added to it at any time, after it has been put in.

The Philadelphia Fire Underwriters' Association have, by resolution, fully endorsed this as a protection against fire.

At the factory of the F. J. Kaldenberg Company, East Thirty-third street, this city,

a complete plant is in operation, having 26 stations. The engine (a Corliss) is arranged to be shut down by it, and a representative of this paper, who, with Mr. C. M. Woolcott, superintendent of the Ongley Company's Works, was recently given an opportunity of testing the system and witnessing its operation, found it working very satisfactorily in every way. It is manufactured by the Ongley Electric Co., No. 1 Broadway, New York.

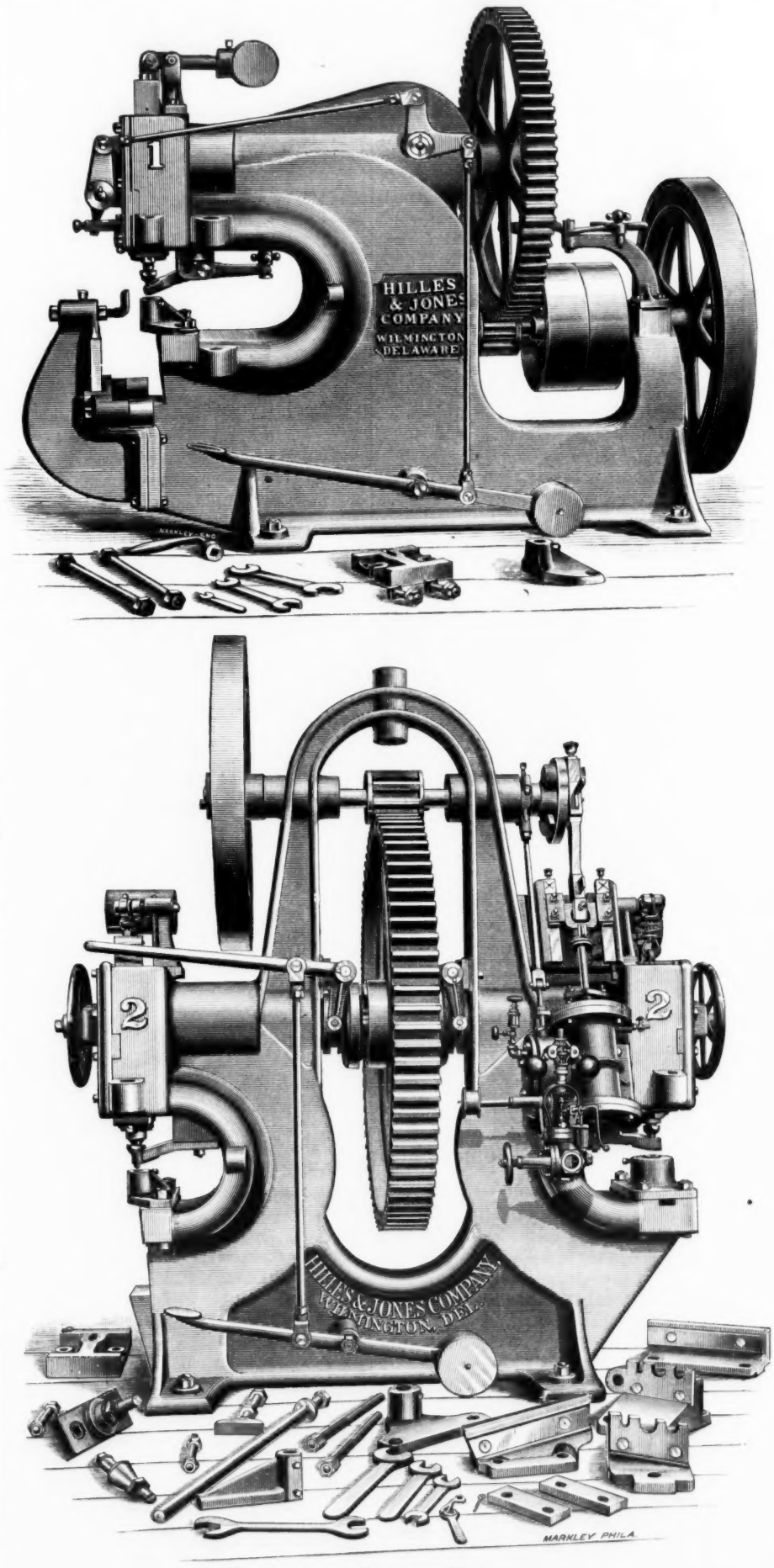
New Punching and Shearing Machinery.

We illustrate on this page some new machines recently brought out by the Hilles & Jones Co., of Wilmington, Del. The machine designated No. 1 is similar to the standard machine built by this company, but differs in some points, as it is made with special reference to work on structural material. It has 20 inches depth of throat, and there is an overhanging steel die block, which is so arranged that channels and I beams can be punched. When other work is to be done, not requiring the space under the die block, the filling piece shown on the floor in front of the machine is put in under the die block. The bracket bolted to the front of the machine is for guiding the work as it is passed through the machine, so that it can be more conveniently handled than would otherwise be possible. The work rests upon the rollers shown, which are adjustable for beams of different sizes from 6 inches to 12 inches. There is a spring on the screw by which this adjusting is done, this spring lifting the beam slightly from the die when it is to be moved along, allowing it to come down onto the die by the force of the descending punch, this feature greatly facilitating the handling.

Instead of the ordinary clutch, the machine is supplied with a "gag," as shown, which can be worked either by foot or hand, as is most convenient. In shops where structural work is done, this has been found to be a very convenient machine, and the same special features can be put on any of the machines built by this company, which we have illustrated from time to time.

The larger machine may be used either as a double-ended punching machine, as shown in the cut, or it may be used with shears in one end. It is provided with the overhanging die block at one side, while the other is of the regular pattern, which is adapted for carrying an extra die block for angle iron, and blocks for trimming plates; also knives and blocks for cutting off round and flat bars.

A self-contained engine is provided for driving, which is supplied with a governor, and all necessary features. The sliding heads are counterbalanced, and there is a spring provided, which takes the shock when punching steel. Either side of the machine may be worked independent of the other by means of the clutches, and either shaft may be rotated by hand, by means of the wheels provided for that purpose, so that punches or shears may be brought down on the work before throwing in the clutch. This machine can be also provided with the adjustable rollers, etc., as shown on the No. 1, if desired.



PUNCHING AND SHEARING MACHINERY.

LETTERS FROM PRACTICAL MEN.

The Born Mechanic.

Editor American Machinist:

You all know him. You've all seen him. There isn't a country hamlet so small that he doesn't inhabit it, and in the cities his name is legion. There isn't a shop or factory that isn't infested with him, and there isn't a foreman, designer, superintendent or master mechanic, that hasn't been pestered with him. His existence dates from his days of mud pies, Barlow knives, wooden windmills and water-wheels. It is said "the child is father to the man," but the longer I live the less I believe it. The good-looking, well-dressed young Demosthenes, who in old days, in the little red country school house, used to knock us all out at spelling schools, exhibitions and "last day" exercises, is now earning his living as a brakeman on a freight train, while the big fat lunkhead, the utter dunce, who never had his lesson, and who, as a youth of 18, spelled cat with a k, is now a rich and prosperous business man in one of our largest cities.

But to return to the born mechanic. As a child he seemed to have a sort of special skill in the use of a jack-knife, and a head full of crude mechanical ideas. His brother, who evinced some desire to become a physician, devoted several years of careful study and experiment to his chosen profession, and after passing the requisite examinations, was turned loose upon the public as a qualified and diplomaed physician. He was probably a poor one, but he was not utterly without knowledge of some of the fundamental truths of his profession. Not so the born mechanic. He bursts upon the world without preparation, full-fledged and equipped, by reason of his innate mechanical genius. The born mechanic's father often owns a shop or factory, and when such is the case, he at once becomes the *bete noir* of the whole establishment.

The born mechanic doesn't know how to "draft," as he terms it; he doesn't know the most rudimental facts of applied mechanics, cannot calculate speeds, strengths of materials, etc.; doesn't know anything about shop practices or methods; in fact, doesn't know anything that is of any use to himself or any one else. He is, however, provided with an all-pervading and obnoxiously evident stock of egotism.

Well, he rushes into the presence of some mechanic, with several sheets of paper covered with marks that he supposes represent a machine. He explains that there is a machine that he wants made. The mechanic asks some questions, and perhaps points out some incongruities; but the born mechanic doesn't like that. There is the machine, and he wants it made just like the "draft."

The mechanic puts some fresh paper on his drawing board and starts in. In about fifteen minutes he is hopelessly up a tree. He finds that he cannot transmit 10 H. P. through a 2" belt running 2,000 feet per minute (as the "draft" calls for), and he also knows that a 2" shaft, running 2,000 turns per minute, should have a bearing over 2" long. He also objects to running a worm and gear 3,000 turns per minute. (These are actual experiences of the writer.)

The born mechanic is called in and consulted, and it usually results in the mechanic being told to go ahead and do the best he can. He does so, and produces a machine as unlike the original "draft" as can be well imagined.

Fortunately, the machine seldom passes beyond the paper stage, so the born mechanic takes the drawings and probably exhibits them, as the result of his inherent and heaven-born mechanical genius. His friends are properly impressed; for—

"Still they gaze, and still the wonder grows,
That one small head can carry all he knows."

He isn't a born mechanic. He is a corruscating and iridescent mechanical ass.

A VICTIM.

An Explanation.

Editor American Machinist:

For the benefit of Mr. W. C. Dennis, I would say that, in my description of an improvised boring-mill, in a recent issue of your paper, I inadvertently omitted to mention that the pulley had been key-seated before being shipped from the factory.

Mr. Dennis will see, by referring to the article in question, that the cutting tool was about 1½ inches ahead of the shoulder on shaft. This space, together with the key-seat, provided ample space in which the chips worked out without getting between the hub and shaft.

BERT LEDALEY.

Justice in Relation to Patents.

Editor American Machinist:

Now that the Copyright bill has become a law, it might be well for American inventors to insist upon a more equitable system of patent laws in foreign countries. A foreign inventor is allowed to take out a United States patent, provided that his invention is not more than two years old. But the American inventor must be very careful not to let his U. S. patent go to issue before he has secured his patents abroad, all of which calls for a heavy outlay of money at one time. The foreigner should be made to treat us as well as we treat him.

Sitka, Alaska. MARINER.

[We do not, at this writing, understand that the Copyright bill has become a law. Regarding the rights of patentees, we suppose each country fixes these rights in accordance with what is believed to be its best interests. If an article has not been in public use for two years in the United States, then it is patentable, notwithstanding it has previously been patented in foreign countries. But we do not believe there is any philanthropy, or attempt at it, in the matter. For obvious reasons, it has seemed particularly desirable for the people of this country to encourage inventors. In older countries, while it may seem to us that equal encouragement should be given, it does not, apparently, seem so to the citizens. We believe that a universal patent law would be an excellent thing for all the nations of the earth; until the time of such a law shall come, it is difficult to see upon what grounds we can find fault with existing conditions. So far as we can see, it is a matter of selfishness all around.]

Simplifying Engineering Knowledge.

Editor American Machinist:

The following letter was received by a publishing house in this city recently, and referred to me with the request that I should

recommend a book suitable to the inquirer's needs:

GENTS—I want a book, or books, on practical engineering with rules of *simple, common arithmetic*, without the cube and square roots and decimal rules. A simple, plain work, as my education is limited to a very small scale of fancy knowledge. The book ("Templeton's Mechanic Pocket Companion") you sent me is a very good book, but altogether too rich for my blood as regards roots, squares, etc., and the decimals are more than I can now properly reach at this stage of the game.

I am a licensed chief engineer of steam vessels, that is, a marine engineer, but there is lots that I don't know that I wish to learn from books, if I can. I most wish to learn how to calculate the horse-power of engines, boilers, derricks, water-wheels, etc., correctly and quickly. The proportion for engines, both marine and stationary, and also all about setting and proportioning the cams and eccentrics by simple multiplication, division, addition and subtraction, and common fractions. In fact, anything and all about the steam engine, electric dynamo, etc.

If you think you have the kind of books—for the pocket preferred—that I want, please let me hear from you at an early day, with prices.

I am in charge at present of a lot of machinery for the coal company here—pumps, haulage engines, and one large double-acting electric pump—and am having very little trouble with my work.

The letter is a model of terse Anglo-Saxon. The writer of it knows exactly what he wants, and asks for it in terms which cannot be misunderstood. If he has not much acquaintance with "fancy knowledge," he certainly can write very plain English.

Unfortunately, I cannot recommend to him the book he asks for, for I cannot recall the name of any book for engineers which does not require a previous knowledge of squares, decimals, etc., before it can be read with any satisfaction. My own education in "the why" of engineering was not begun until after I had studied arithmetic, geometry and algebra, to some extent at least; and therefore I was able, with great difficulty, I must admit, to master some of the engineering books I afterward became acquainted with. Possibly some of the readers of the AMERICAN MACHINIST may, however, know of some such book as is wanted, as they may have been through the same experience as the writer of the letter; that is, they may have acquired their engineering knowledge before they knew how to wrestle with decimals and the square root.

If I only knew how, I would write such a book myself, for the benefit of the writer of the letter, and of others like him, who would like to increase their book knowledge of engineering without having to go through a course of mathematics as a preliminary. I don't know whether or not I could write such a book, even if I had the time, as I have not; but if any one else thinks he can I wish he would, and I will give him an idea of how to write it, as follows:

Suppose the author wishes to write on how to calculate the horse-power of a steam engine. If he were writing for those educated in the use of formulæ, he would say:

$$\text{Horse-power} = \frac{PLAN}{33{,}000},$$

in which P = mean effective pressure in pounds per square inch; L = length of stroke in feet; A = area of cylinder in square inches; N = number of single strokes per minute.

Now let us translate this short formula into language which may be understood by our anxious inquirer, whose knowledge of arithmetic does not extend beyond the first four operations; and we begin as follows:

Multiply the area of the cylinder (explain what an area is, and how to get it from the diameter, explaining diameter of course; that is, multiply the number of inches in the diameter by itself, by 7,854, and divide by 10,000) by the mean effective pressure which is obtained from the indicator diagrams taken from each end of the cylinder (explain what an indicator is, what a diagram is, and how it is obtained) by taking the average height of the diagram (explain how to do this), multiplying it by the scale of the indicator. (The average height of the diagram, however, or even the measurement of any single line across the diagram, will bring in either common fractions or decimals of an inch. If we measure the diagram by a scale divided into fortieths or other fractions, corresponding to what is known as the scale of the spring, then we must bring in fractions.)

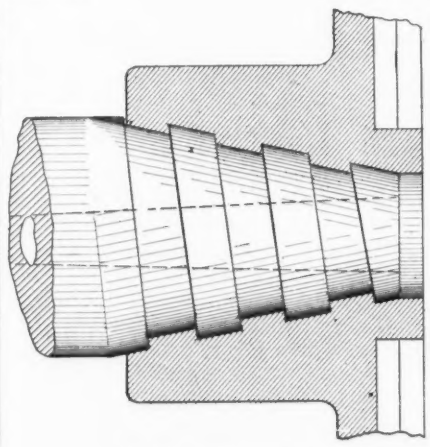
So my chapter to take the place of the short formula will be a failure, for I cannot explain it without saying something about either fractions or decimals; and I don't know how to write an explanation of any engineering calculation which can be understood without some of this fancy knowledge. Is there any bookmaker who has done it? And, if he did do it, is the book good for anything?

The ambition of the writer of the letter is entirely praiseworthy. It would be a pity if such a man should fail in his ambition to become an educated engineer, but I do not see how he can make any short cut to getting his education any more than the rest of us did, who had to learn our multiplication table before we were advanced to compound numbers or fractions, and who had to learn some algebra before we were instructed in or allowed to study applied mechanics. Why, even in the technical schools the professors are complaining that they have to take the first year of the course to drill the insufficiently prepared freshmen in mathematics before they are fit to begin to study engineering.

Mathematics is the very foundation of engineering, and the latter cannot be profitably studied without a severe preliminary training in the former.

I would advise the "anxious inquirer" not to seek further for an elementary book on engineering, but to get some smart school boy, who understands decimals, squares and cubes, and a little geometry and algebra, to give him some instruction in these branches, and after he has mastered them he will be able to understand the engineering pocket books, and he can then make good progress in self-instruction in engineering.

TECHNICS.



Lathe Construction.

Editor American Machinist:

From recent discussion in your paper, in regard to lathe construction, it seems that none of the existing methods of attaching the face plate to the spindle meet with popular favor. I have designed a plan of attachment which would seem to meet part of the objections urged against some of the modes proposed. The sketch shows the idea, which is to make the screw all taper, and a very quick taper. Make the thread shallow, and let the face plate come up on the entire length, bearing well top and bottom.

This would dispense with the usual collar on the spindle, which is an expensive adjunct when made out of the solid.

This form of thread could be ground top and bottom after the spindle was hardened, thus insuring lasting trueness. Cutting a liberal key-seat in both screw and hub would tend to clean out the thread while screwing on. In use, face plates and chucks could be quickly put on and removed, as a turn or two would free all contact. With the coarse pitched thread and quick taper, things should start off easily.

This plan allows the bolt slots in the face plate to be brought near the center, which may be thought an advantage. It also seems to meet the objection raised by one of your correspondents as to the liability of some chucks wearing more than others, and so losing their fit, as no reasonable amount of wear will vitiate the tightness or trueness of chucks, or change their position on the spindle to a harmful extent.

BENJ. F. WILSON.

Why Foundry Owners Should Educate their Foremen, and How it Should be Done.

Editor American Machinist:

The art of molding and producing castings differs from all others. Theory is of but little account. It cannot be used to produce a casting. It may be used to a certain extent to mold by, but it cannot tell us how to make a casting. Experience, with the help of good judgment, alone, can produce good castings. Therefore the more experience and good judgment a man may have, the better workman he will make.

Molding has a great many small branches in itself, such as loam, dry sand, green sand, heavy and light green sand, dry sand and green together, snap flask work, swept work, hollow ware, stove plate, and a large number of other branches that are common. A man may serve his time in a foundry making a specialty of any one of these branches, or in a shop where three or more of them are used. Such shops are called job shops; you will find where a shop has so many different branches of the trade that no one of the branches is given the care that is given in a shop making a specialty of one branch. The time has come when all staple machines are built in large lots; this saves cost, both in machine work and in castings. The small job lots of castings are growing smaller every day, and this work going to a foundry that is equipped to handle it fast and cheaply. The job shop of to-day must be up to all the tricks of the special shops, to compete. In running such a shop at the present time one must be prepared to do all kinds of work, and do it as cheaply and fast as a shop making a specialty of one class of work.

The question will arise: Well, what is to prevent us from doing this? we have room, and power, and a good smart foreman. Perhaps you have a good foreman, but does he know it all? If so, how did he learn it? Steady, reliable men do not travel around the country much. Their services are always in demand, and they do not get a chance to see all the branches, and the different ways of doing work. Their ideas are limited to what they have seen in the places they have worked in. Perhaps the foreman is from a job shop. If so, he has a general knowledge of all the branches, *as the work is done in a job shop*, or in the shops he has worked in.

But how can this be remedied? In the first place, you want a foreman for your shop; you look around; you pick out a man that is steady, and who has good judgment; one that can handle men, and that is willing to receive as well as to impart knowledge. This man, if young, will have a certain amount of ambition. He has been a good, reliable workman, he has not been allowed to travel around the country much; his services have been in constant demand. He is from a job shop, and is to be foreman of a job shop. He is the man you want. Now, encourage this man's ambition to become a good foreman. Give him as good pay as you can afford. If he advances good ideas, show him you appreciate them.

But how can you educate him? By sending him on a trip around the country to see how work is done in different places. Perhaps he will first call at a stove plate shop. This is out of his line, yet here he sees them put up a large amount of work; he will think to himself, I have not got a man that could do more than half that amount. He wants to know the reason, and he finds it in the way the patterns are finished and boarded; in the way the flasks are made to fit. Then he will see the match boards used, and the way they rumble those thin castings without breaking them.

He next goes to a snap flask shop, and here he sees work made in snap flasks he had no idea could be so made; he finds the reason of it, and will see how cheaply they make this class of work, and how it is cleaned.

He will next visit a shop doing dry sand and loam work. There he will see his own ideas carried out, along with others. They make a specialty of this work, so are better fitted for it than he is, and can make the work faster. It will be a great study for him.

He will next go to a sash weight shop. Here he will see the use of match plates, and how cheaply the work is done. If he gets a chance to look into the furnace after a heat of old tin cans and burned iron, he will smile. Here he will get some ideas about cleaning out a furnace.

From there he goes to a car wheel shop; here he can pick up points on chilling, cracking and annealing. From there to a shop making building work. Then he looks at those large columns, and compares his day's work with a day's work there, and notes the difference and the reason for it. He will find it in the rigging, and the way they make the work; it is their specialty.

From there to a cotton machine shop; here he sees all branches fitted up in different ways, and cheap help used. Then to a pipe shop making water and gas pipe. If he has never seen it before, it will surprise him to see them turn out work.

But what will he gain from all this? He has seen different shops doing the same work different ways; he now compares them with his own, and will adopt the one he likes best. He has seen all branches of the business done in different ways, and different prices paid for the work.

When he goes back to his own shop there has just been received a large order for thin plate work. His mind goes out to that plate shop, and he recalls just such a job as that, and how they were rigged for it. Or perhaps a lot of small work; he wants to put it in a snap flask. The snap flask shop appears before him with its rigging. And so on through his whole career as a foreman, his mind will go back to those shops doing that special work.

I do not mean to say this foreman has no good ideas of his own, but it takes us all to know it all. Man's life is too short to know it all himself. We all have different ideas; some are good and some are bad. No matter how good a foreman you have, he can be taught every day, and sometimes by his apprentices. You want to give your young foreman all the knowledge you can to go with his ambition. If you wait for him to learn in your shop, by the time he has obtained a good stock of ideas his ambition has gone. The process is too slow.

The foregoing does not apply to young foremen alone. The older ones should be allowed to look around, or they are liable to get behind the times. The cost of sending a foreman on such a trip would be nothing compared with the gain.

W. F. P.

The Measurement of Power.

Editor American Machinist:

Permit me to add another supplement to Prof. Flather's articles on the measurement of power, this time only to corroborate his measure of the power consumed by a small engine lathe making a light cut, with a diamond tool. This he made to be 0.102 horse-power. I have on my record book tests of three similar lathes made in different places at different times, but making similar cuts, with the "balanced dynamometer," which he described and illustrated about a month since. They show respectively 0.092, 0.098 and 0.080, the last being a very small lathe, and I take 0.100 as my basis, when estimating without measurement. A larger "Windsor lathe," 6-foot bed, making a deep cut on round iron 1¼ inches diameter, at medium speed, gave me 0.212 horse-power, or about double the light cut.

SAMUEL WEBBER.

Horse Cars and Electric Traction.

Editor American Machinist:

Horse cars have become unpopular since the advent of the cable and electric motor traction, but it is nip and tuck as to which is the cheaper of the three systems. However

that may be, there is one other scheme that I would venture to suggest: Gas engines are the most economical of all small motors, and if these be used on street cars in lieu of the electric dynamometers, using compressed gas, carried in cylinders aboard the cars, a system will be evolved that may rival the others in economy, without sacrificing any advantage of the motor cars. Gas engines as they are now made are not suitable for locomotives, but if a necessity for it exists the "gas locomotive" will be developed accordingly.

C. W. CRAWFORD.

Octagonal or Round Steel?

Editor American Machinist:

In your February 5 issue Mr. John Barnard has an article on lathe centers, arbors, etc. I like his ideas; he is all solid on the center hole question, and it is a very important matter. I also think well of the lathe center with a notch in the side for the point of the side tool; but when he tells about getting a piece of octagon steel to make his arbor of, we part company.

Now, Mr. Editor, and brother machinists, what I am about to write will be expressive of a train of thought that occurred to me long ago, and the article referred to has fired the train. The point I wish to make is this: What earthly use have we machinists got for octagon tool steel? How often do we make anything that is octagon in shape, and if we had to, would we use round steel? Of course not; we would use octagon. Then why use octagon steel to make round work of?

Right here some fellow will jump up like a jack in the box, and gravely tell us that round steel is not so good as octagon; that round steel is rolled, and octagon is hammered, and that makes it better. Now there may be something in the squeezing action of rolls that is bad for steel, and perhaps if an ingot was reduced to a small bar in that way, pins might be produced and rolled in, making seams; but the fact is, I am told, that all the first-class round tool steel is now hammered in grooves, swaged, in fact, the bar being turned and drawn back and forth until it is reduced to size.

I have not bought any octagon steel for years. I use Thomas Firth & Son's round tool steel; it is made by 32ds of an inch from $\frac{1}{8}$ to 2 inches, and I often turn a job on $\frac{1}{32}$ of an inch reduction. This steel is very round, very accurate to size, and quite straight. It seems as though it must be sized in rolls, at least, but it has a fine blue scale on it, and is very smooth, just like a fine hammered job. It can be worked without annealing, but when annealed—and it anneals easily—it works splendidly.

William Jessop & Sons are sending out their round steel, both annealed and unannealed, and no man with ordinary facilities can anneal it half so well. I suppose all the American steel makers make round tool steel. I tried a piece of one make once, but I couldn't anneal it so it would work well at all, and gave it up.

The use of octagon tool steel for round work is a relic of barbarism, for which the blacksmiths are partly responsible. They won't buy round tool steel if they can help it. It is time that the army of machinists who get their steel from the machine blacksmiths made a determined and vigorous kick for round tool steel. The use of octagon steel has wasted hundreds of tons of steel, and worn out thousands of dollars of lathes, and still it goes on. A bar of octagon steel is octagon all the way through, and when turned off and hardened it goes in all directions, as you will find if you put it in a grinding machine.

All the makers of taps, reamers, cylindrical gauges, and such tools use round steel, and they could hardly afford to take the gift of octagon; the latter has its uses; it is all right for rock drills, cold chisels, punches, and for forging; but for round work give me round steel.

Some of your readers may get the idea that I prefer English steel; I certainly do, and can give reasons for it; but I do think that, considering the high cost of Swedes iron in this country, our steel makers have done very well, and that they are entitled to much credit. I have been looking for some comment or discussion on the letter from Mr. Taber, of the Morse Twist Drill Company, but I suppose you could hardly admit anything of the kind in your columns.

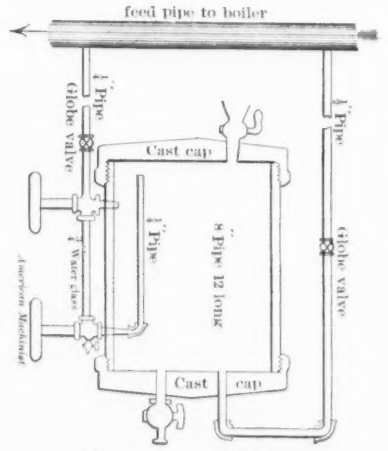
H. K. PORTER.

Kerosene in Boilers.

Editor American Machinist:

Having received a great many useful kinks from the boys through your paper, I beg leave to give my experience in regard to kerosene as a boiler compound. I have charge of two batteries of boilers using different water, and had been having considerable trouble in keeping tubular boilers free from scale. In fact, it was next to impossible. I used a compound at 80 cents a gallon, with no brilliant results, and then it occurred to me to give kerosene a thorough trial. I had used it some, but did what I suppose plenty of other fellows did—put it in in doses when cleaning out, and let the water chase it up the sides of the sheets and tubes. But the doses were not frequent enough to do the work properly. I then rigged up a "thing-umajig," as the fireman called it, and put it on the suction of the pump, giving pump and heater the benefit of the oil. I used this long enough to prove that I was on the right road to clean boilers. But a new obstacle stood in my way, for whenever the boys cleaned out the heater there were four or five gallons of oil lodged in the top of the heater that would be wasted. So I set my wits to work, and, going into the odds and ends on hand, I found an 8-inch nipple about a foot long. I then took two cast caps and screwed one on each end, and as pipe from heater to boilers ran along the wall about ten feet from the wall, I tapped it for half-inch pipe, and bringing it down far enough to make it handy for filling, put two elbows and two nipples on the lower end, to make it come into the bottom of oil holder, which I set up endwise, and put a valve in this pipe to control supply of water to oiler.

I then got a $\frac{3}{4}$-inch water gauge and put it on the other side for a sight-feed glass. Where the lower gauge reached through the shell I attached a $\frac{1}{4}$-inch pipe and run it up to near the top to take oil as the incoming water drove it up. The feed can be regulated to a nicety with lower valve, and passes up in visible drops and goes to feed pipe through $\frac{1}{4}$-inch pipe attached to top of gauge, which can be screwed in by taking out the plug generally found in all water gauges for cleaning the glass. This plug or another should be screwed in top gauge where it comes through the shell inside. Then take an old pet cock that has gone out of use, and with a hack saw saw it in two and file it to fit in the bottom gauge. Put a rubber gasket under it, and let the glass down onto it, with bib pointing up through center of glass, and after getting in a $\frac{1}{4}$-inch cock in the bottom to let out water, and a common alcohol cock same as is used to fill



KEROSENE IN BOILERS.

meters at top, for filling, you will have a rig that will physic your boilers and keep their insides in good condition with the least expense and do it good.

There is no getting around it, kerosene is the best boiler compound of them all. It is not like crude petroleum; it leaves no residue, and you can safely feed it without danger of coating shell or tubes and keeping the water from them. I know a set of water tube boilers using Lake Superior water, that got so bad that it was thought they would have to be taken out, and the little innocent drops of oil were sent on their way, and drop by drop, slowly but surely they got in their work, and in less than two months, running night and day, those boilers were like new, and have been so ever since.

Drummond, Wis. E. E. CLOCK.

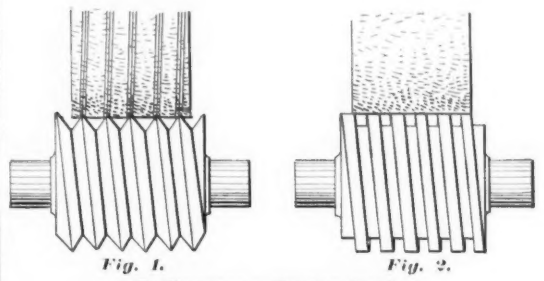


Fig. 1. *Fig. 2.*

To Improve a Truing Device.

A Scheme to Improve a Grindstone Truing Device—The Reason—Adverse Opinion—Use.

BY JARNO.

The reason why I like Mr. Norton's mechanical schemes is because they are so carefully thought out, and are derived either from something he has tried or has seen others try. He has no objection to adopting the suggestions of others, and is wholly unlike Waubug, who condemns everything brought out by a man that he does not happen to like.

One of the better kinds of truing devices in use at present consists of a threaded roll that rotates while being rigidly held against the stone, as suggested in Fig. 1. The action of the thread is, first to make grooves in the stone, and then, as the roll rotates and the thread moves across, to turn or push off the lands between the grooves. The scheme of Mr. Norton's that I speak of to-day relates to the shape of the thread. Usually, when the roll is new the thread is sharp. Now, he says that, instead of being sharp, it would be better square, as in Fig. 2. He reasons that it is easy enough to groove the stone with the sharp thread, but it is not so easy to turn off the lands by the threads pressing sidewise. Sometimes the roll rotates a certain whole number of times while the stone rotates once, which tends to make a series of spiral grooves deeper and deeper. When the relation of speeds changes, which it does after a time, the high lands are hard to turn or crush off. Now, a sharp, or narrow thread leaves lands in width nearly equal to the pitch of the thread, and all the harder to crush off. When they do finally give away, the roll, being under strain, jumps so far sidewise that the thread either drops in another position into the grooves or makes new grooves without crushing off the intermediate lands, and the stone is not turned smooth.

Now, though it does not groove the stone so easily, yet the square thread in Fig. 2, of the same pitch as Fig. 1, crushes off the lands more easily, because they are not so high nor so wide as Fig. 1. Hence, there is less jumping, and, because the top of the thread is flat, the stone is not turned so rough.

Now comes another point of view. Mr. McGregor had been a silent listener to this recital. He is a good listener, and does not, like Waubug Mephit, continually interrupt one, and then say that one can put one's thoughts in a great many words. In a few days Mr. McGregor tried the square thread scheme, but did not like it. He invited me into Brown & Sharpe's to witness the operation. The thickness of the thread was a twentieth inch, the pitch being one-tenth. The roll made a great noise, as if working very hard, and after a long time turned the stone smooth, but not true.

Mr. Norton has successfully used the square thread at Leland, Faulconer & Norton's, and hence we must seek an explanation as to why he succeeded and Mr. McGregor did not. In reaching a decision, I think that the difference between the two is not hard to understand. No doubt Mr. Norton had a narrow stone, and the roll fastenings were relatively strong. Mr. McGregor had a wide stone, which called for excessive strength of fastenings On the whole I would say, inasmuch as the thread in Fig. 1 is soon dulled and yet works fairly well when not very dull, that it can be made something like Fig. 2, but quite narrow; have it a fortieth inch thick instead of a twentieth. When we get Fig. 2 suited to the stone and to the fastenings we shall have a roll that will last a long time, because the thread does not become wider as it is worn. A wide slot can be cut with a chisel and a file; it can also be cut with a square-nosed tool in a planer, but a one-inch tool is better in a sixty-inch planer than in a sixteen-inch.

As to the use of truing devices, Mr. McGregor has some grindstones trued every day, and others twice a day. To do this he does not want a man of high-priced judgment. He has found that too good judgment, and a too high grade of skill, are qualities that unfit a man for this work, as they cause him to think of so many other things that he forgets to attend to so simple a matter as keeping the grindstones true. Hence he hires a man that can be impressed with the dignity and necessity of managing grindstones. The man of judgment counts the jolts and estimates their depth, in order to know when to true the stone. But this is not what Mr. McGregor wants, as he has plenty of help to attend to the jolts, so that he wants a man to attend to the truing.

If there is anything in the world on which the average newspaper writer gets hopelessly astray it is a boiler explosion.

Recently there was a disastrous boiler explosion at Quebec, by which thirty or more persons were killed. There was trouble at the works of the worsted mills, the machinery not being started up as usual in the morning. The employes had mostly left, when about 10 o'clock the explosion occurred. Now for the assigned cause: This is that some of the pipes were frozen. Suppose the pipes were frozen; there is no reason in the world why this should cause an explosion. A boiler is supposed to be provided with safety valves sufficient to take care of it under any circumstances, and there is supposed to be an engineer in charge who knows how to stop the production of steam when there is no legitimate way to dispose of it. It is time for the "frozen pipe" and the "pump didn't work" theory to get a rest. When a boiler explodes under such conditions as that at Quebec there is something wrong—something that ought to be investigated.

The Bangor *Industrial Journal* publishes a special edition containing a summary of the shipbuilding industry in New England. It shows that during 1890 there were launched from the shipyards of the New England States and the maritime provinces 313 vessels, aggregating 132,015 net tons. These, classified by rig, are as follows: Seven ships, 11 barks, 24 barkentines, 10 hermaphrodite brigs, 200 schooners, 30 sloops, 21 steamers and 10 barges. Of this fleet, New England contributed 207 vessels, aggregating 99,842 tons, and the maritime provinces 106 vessels, of 32,173 tons. Of the New England contribution, Maine leads with 125 vessels, of 74,465 tons; Massachusetts comes next, with 54 vessels, of 13,603 tons; and Connecticut follows, with 82 vessels, of 11,772 tons. In the maritime provinces, Nova Scotia leads, with 64 vessels of 23,779 tons; New Brunswick follows, with 36 vessels, of 6,667 tons; and then comes Prince Edward Island, with 6 vessels, of 1,729 tons.

The Panama Canal Company has concluded arrangements with the United States of Colombia by which the time for completing the canal is to be extended ten years. Other arrangements have also been made, one of which is that work shall be resumed before February 28, 1893.

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Profit Sharing.

Profit sharing is gaining ground very slowly in this country; still it is gaining. If all men were equally intelligent, and all were honest, it would probably gain faster, for a time at least.

In profit sharing, all parties to the agreement, generally speaking, expect to make money. There may be instances in which the employer voluntarily surrenders a part of his ordinary profits, but we think such cases of disinterested benevolence will be found extremely rare. The workmen always expect to make money. There is an agreement on the part of the employer to divide a certain per cent. of the profits of the business amongst his workmen, and, although it may not be stipulated, it is understood that the workmen will exert themselves to increase his profits. This is what the employer expects. There is nothing wrong about this; it is business, pure and simple. The employer expects to make more money, as well as the workmen. On any other basis than this, profit sharing would never spread to any extent.

But it is not all plain sailing. If, at the end of the year, there are no profits to divide, there is likely to be dissatisfaction amongst the workmen, unless, indeed, they are men of superior intelligence; while, if it does not appear to the employer that more work has been done, he is dissatisfied. There is always danger of dissatisfaction, unless the agreement is between men who, honest themselves, do not expect dishonesty in others. Many a year's business is done by the manufacturer, that shows no profit; unless workmen recognize this fact, and are prepared to accept the result as a matter of course, it would seem to be idle to enter into an agreement for sharing profits.

Another thing likely to interfere is the exaggerated idea that workmen often get of the profits of a manufacturing business, hence their disappointment at the amount they receive, even in fairly prosperous times. Perhaps there is nothing in regard to which intelligent men are more likely to be mistaken than in the profits, generally, of manufacturing. The mere cost of a thing in the shop or factory may be estimated with reasonable exactness—so many days work, and material representing so much in dollars and cents. But the cost both sides and all around this are overlooked or estimated at a figure entirely too low, such as the cost of marketing what is made, interest and depreciation, supervision, and other necessary expenses.

These are all difficulties that can and will be overcome if it is found that profit sharing is the most equitable means of securing justice as between employers and workmen.

Profit sharing will, if equitably done, give workmen an opportunity to earn more wages—not to receive something as a gratuity, except, as was before said, in rare instances. This so long as it is the exception rather than the rule. Were it to become universal, it is difficult to see how it could do even this. But there is, at the slow rate of progress, little prospects of its becoming anything like universal for some generations.

Compulsory Licenses from Patentees.

Most of the attacks which are made upon our American patent system are unjustified, and for that reason may be expected to have ultimately little or no effect upon public opinion. But occasionally some one is able to show wherein and how an oppressive monopoly is protected by the patent system, and improvements and inventions actually discouraged by the very laws intended to stimulate them. This was done recently by a correspondent of the *Evening Post*, Mr. Andrew H. Smith, who took as an example the operations of the Bell Telephone Company, which refuses to sell instruments, charges an exorbitant rental for them, and even refuses to allow subscribers to use at their own expense a simple device for improving the instrument, so that it can be more plainly heard, at the same time offering to improve the service to about the same extent upon payment of further heavy rentals in addition to those already paid.

Another performance by this company, which was not referred to, might well have been mentioned also.

It is charged—and so far as we know has not been contradicted—that the Bell Telephone Company has, by purchase, become the owner of both sides of an interference case which has been pending for some years in the Patent Office, and which is not making the least headway towards a settlement, the company being able to prevent such headway, and doing so, evidently, for the purpose of delaying the issue of the patent in dispute until near the expiration of some of the present patents, when, by withdrawing one side or the other of the interference case, the patent can issue and will prolong the present monopoly for another seventeen years.

The remedy proposed by the writer referred to is to compel every owner of a patent to offer for sale the article patented at a maximum price (proportionate to the cost of manufacture) fixed by law.

Replying to the communication, Mr. George H. Benjamin calls attention to the fact that since 1883 a law has been in force in England which covers this point, and which he quotes as follows:

COMPULSORY LICENSES.

Section 22. If on the petition of any person interested it is proved to the Board of Trade that by reason of the default of a patentee to grant licenses on reasonable terms:

(*a.*) The patent is not being worked in the United Kingdom; or

(*b.*) The reasonable requirements of the public with respect to the invention cannot be supplied; or

(*c.*) Any person is prevented from working or using to the best advantage an invention of which he is possessed, the board may order the patentee to grant licenses on such terms as to the amount of royalties, security for payment or otherwise, as the board, having regard to the nature of the invention and the circumstances of the case, may deem just, and any such order may be enforced by mandamus.

Yet this law has been practically inoperative, very few applications for compulsory licenses having been made under it, and not one granted.

It might be different in this country, but we expect that the applications under such a law would be surprisingly few even here.

As Mr. Benjamin points out, a very large proportion of our manufacturing interests is based upon the patent system, and there should be no tinkering with it, except after the most careful consideration and thorough investigation. But the fact remains that a case like that of the Bell Telephone monopoly does more to inspire effective opposition to the patent system than all the attacks of the professional reorganizers of society, for it gives conservative and well-meaning people, not thoroughly conversant with the patent system and its importance, a genuine reason for opposing it.

Another curious legal decision is that of an Iowa judge who declared that a boy who emptied a nickel-in-the-slot machine by means of a nickel with a string tied to it, was guilty of nothing in the eyes of the law for which he could be punished, as he had merely done what the inscription on the machine told him to do, nothing being said by the inscription about leaving the nickel in the machine after it had been dropped in. The Chicago *Journal* says this decision "will probably abate a nuisance." But it will probably do nothing of the kind, even granting that the machines are a nuisance; for it will be easy to arrange them so that no nickel with a string to it will trip the mechanism, or so that no string will draw the nickel out after it has operated the machine. And as to the machines being a nuisance, this is at least disputable. If the public did not wish to patronize them they would not pay, and would soon be withdrawn. The machines can retail chewing gum as well or better than a man, and give the man an opportunity to engage in better business.

Secretary Hutton announces that the third social reunion of the Mechanical Engineers will be held at the society's headquarters, 12 West 31st street this city, the evening of Thursday, Feb. 26th. The complete success of both the preceding reunions, gives grounds for the belief that the coming one will also be successful. Prof. Thomas Egleston has presented the society with a notable table which was once the property of Robert Fulton, and this has suggested the idea of calling the gathering a "Fulton Evening," and it is expected that members will present facts and reminiscences of Fulton and early steamboat engineering in this country. Music and an exhibition of lantern slides will enliven the occasion, and there will be a collation at 9.30.

It is further announced that the Spring Meeting for '91 will take place at Providence, R. I. Though the precise date has not yet been fixed, it is expected to be about the second week in June, which is a little later than usual, in order to intersect the clam bake season, for which Rhode Island is so justly famous.

Literary Notes.

MAXIMS AND INSTRUCTIONS FOR THE BOILER-ROOM. Useful to Engineers, Firemen and Mechanics, relating to Steam Generators, Pumps, Appliances, Steam Heating, Practical Plumbing, etc. By N. Hawkins, M. E., Honorary Member National Association of Stationary Engineers, Editorial Writer, Author of the Hand Book of Calculations for Engineers and Firemen, etc.

This book will be published in ten parts, two of which we have seen. The author commences by treating on the different kinds of fuel, explains the tools used in the boiler-room, and gives directions for firing with various fuels, including points relating to firing. His chapter on Don'ts is well worthy of careful perusal and study, and the chapter on the growth of steel boilers cannot fail to be instructive to beginners. If the parts we have seen indicate the character of the whole, we can recommend the work to all who are interested in, and wish to become acquainted with the management of steam generators. Since the author endeavors to instruct beginners, as well as the more advanced student, some of the matter contained in the work is necessarily very simple, and the whole is made very plain and interesting, conveying to the student the leading principles of the profession, and giving much valuable advice and information. The work is to be completed in ten parts, price of each 25 cents. They are published by Theo. Audel & Co., 91 Liberty street, New York.

Questions and Answers.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(88) R. R. B., Shenandoah, Va., asks: How would you set locomotive valves? *A.*—A practical example of setting locomotive valves is given in our issues of April 10 and May 14, 1887.

(89) J. N. D., Warren, Pa., asks: Are there six steamships which use between 300 to 400 tons of coal in 24 hours? *A.*—There are steamships which use that amount of coal, but we do not know how many.

(90) J. A., New York, writes: Kindly inform me whether there are any works published on anhydrous ammonia and ice refrigerating machines, and where can they be obtained? *A.*—Thermodynamics, Heat Motors, and Refrigerating Machines, by Prof. De Volson Wood; or Ice-making Machines, by M. Le Doux, may help you. These books can be obtained from any dealer in scientific works.

(91) A. C. H., Chicago, Ill., asks: Can the horse-power of a locomotive be computed? *A.*—Yes. It is found by the ordinary rule: Indicated horse-power $= \frac{P \times L \times A \times N}{33{,}000}$ in which P denotes the mean effective pressure for square inch of piston; L length of stroke; A area of piston in square inches; N the num-

ber of strokes per minute. This will be the horse-power for one cylinder, which must be multiplied by 2 for the total horse-power.

(92) G. D. B., Trenton, Pa., asks: Will you please inform me where I can get a book containing information on brass molding and all work appertaining to a brass foundry? Please also give price of book. *A.*—The Practical Brass and Iron Founder's Guide, by J. Larkin, may help you, but you must not expect to find in any book all the knowledge which a good brass molder requires. Price, $2.25; you can obtain it from any dealer in scientific works.

(93) J. D., Streator, Ill., writes: I have looked in numerous books and papers, but can find nothing on the following subject. I know that in computing an angle by tangents the side opposite the angle is divided by the side adjacent to it, then by referring to a table the angle is found. Now what I want to know is, how to find the angle without the table of tangents. Suppose I was so situated as not to have a table, how can I find the angle? *A.*—To find the angle requires too much labor; engineers never attempt to find it without the table, and if none is at hand the problem is given up.

(94) F. R. H., ———, writes: I want to make a turret head attachment for common engine lathe. Will you tell me the simplest form of mechanism that can be used for automatically rotating the head? *A.*—Such a question is altogether too comprehensive to be answered in these columns. We are familiar with the mechanism used for that purpose by a number of builders of turret head machines, but whether any of these use the simplest form of mechanism or not, we cannot say. All that can be done in such a case as this is to study the means by which others accomplish the desired ends, and then devise the simplest and best thing possible, taking care to steer clear of patents. This will involve work which it is obvious we cannot undertake to do in these columns.

(95) W. C. H., Albion, Mich., writes: Will you kindly inform me what is meant by a "counter-stream" condenser? I am not a subscriber to the AMERICAN MACHINIST, and so would consider it a very great accommodation if you will answer. *A.*—The term "counter-stream condenser" is an unusual one in steam engineering practice, but we take it to mean Wheeler's patent surface condenser, in which two sets of tubes are used, one set inside of the other. In these condensers, the circulating or cooling water enters and flows through the inner tubes, and then returns through the annular space between the two sets of tubes. We always take pleasure in answering any questions relating to our specialties; it makes no difference whether they are asked by subscribers or not; in fact, the editors do not usually know who are subscribers.

(96) W. H. N., Preston, Minn., writes: Our State boiler inspector asked me some questions at an examination which I was unable to answer, and could not find anything in regard to these subjects in books. He claims that a boiler will pulsate, and when in that condition the water in the glass gauge will rise and fall, and the needle on the steam gauge will vibrate at the same time. It is claimed that this is a sure sign of an explosion. *A.*—When the water rises and falls in the glass gauge it is a sign that the steam is drawn out faster than it is formed; it is a dangerous condition for a boiler to be in, and may lead to an explosion. 2. How many ways does a steam fire engine take water? *A.*—We do not quite understand your question; if you refer to the suction, it takes water in as many ways as it has openings for the suction pipe.

(97) J. W., Halletsville, Texas, writes: Please kindly explain how one can get the correct idea of the pressure in a boiler? *A.*—The pressure per square inch in a boiler is indicated by the steam gauge. If the boiler is cylindrical in form, and the steam gauge indicates 50 pounds, then the total pressure tending to burst the boiler is found by multiplying the inner diameter in inches by the inner length of the boiler in inches, and by the pressure indicated by the steam gauge, namely 50 pounds in this case. The stress in one inch of metal measured longitudinally is equal to the product of the inner radius into the pressure indicated by the steam gauge. If the boiler has any flat sheets, such as are used in locomotive fireboxes, then pressure indicated by the steam gauge is the pressure on every square inch of the sheet. 2. Will 100 pounds on a scale correspond to 100 pounds indicated by the gauge? *A.*—Yes. 3. If the pressures indicated by the safety valves and the gauge do not agree, which is the most reliable? *A.*—A discrepancy between the safety valve and gauge shows that there is something wrong with either one or the other, and neither should be depended upon; the defect should be found and corrected.

(98) H. L. T., Grand Forks, N. Dak., writes: Please answer the following: What is the increase in the pressure of a column of water as its height is increased? That is to say, will the pressure of a column of water 100 feet high be just double that of one 50 feet high? *A.*—Yes. The pressure of water varies directly as the depth below the free surface. To find the pressure per square inch of a column of water, multiply its height in feet by .434; the product will be the pressure per square inch. Thus, the pressure of a column 100 feet high will be $100 \times .434 = 43.4$ pounds per square inch, and the pressure of a column 50 feet high will be $50 \times .434 = 21.7$ pounds per square inch, which is exactly one-half of the former. 2. What will be the difference in the amount of water running through the same size of pipe, say at 50 and 10 feet head? *A.*—For computing the discharge, it is customary to find first the mean velocity in the pipe, which may be computed by the following formula:

$$v = \sqrt{\frac{64.4 \times h}{1.5 + \left(f \times \frac{l}{d}\right)}}.$$

In which h denotes the head in feet; f the friction factor; its value varies from 0.01 to 0.05 for new, clean pipes; it decreases both when the diameter and when the velocity increases. A rough mean value, often used for approximate computation, is 0.02; l denotes the length of pipe in feet; d its diameter in feet; and v the velocity in feet per second. The discharge per second is found by multiplying the velocity of discharge by the cross-sectional area in square feet of the pipe. If we denote this area by a, and the discharge by Q, then we have

$$Q = a\sqrt{\frac{64.4 \times h}{1.5 + \left(0.02 \times \frac{l}{d}\right)}}.$$

The discharge obtained by this formula is nearer correct for a pipe whose length is about 100 times its diameter and over, than for shorter pipes. For short pipes the discharge is greater.

(99) J. T. E., Riverhead, N. Y., writes: Kindly inform me whether a young man who has not a license to run a marine engine loses his rights for a license or not. *A.*—No. A person can only lose his license through incompetency, or neglect of duty. 2. Please give rule for finding the tonnage of a small boat. *A.*—There are various kinds of tonnage measurements actually in use. For instance, there is the displacement tonnage, register tonnage, freight tonnage, yacht and boat sailing tonnage, and various other kinds. Some of these "tons" represent dead weight, others represent capacity, and some are empirical measures representing neither weight nor capacity. With such a variety of measures, and so many kinds of tons, careful discrimination is obviously needed to prevent mistakes when dealing with the tonnage of ships. The displacement, or gross tonnage is sometimes approximately estimated as follows: Let L denote the length in feet of the boat; B its extreme breadth in feet, and D the mean draft in feet; the product of these three dimensions will give the volume of a parallelopipedon in cubic feet. Putting V for this volume we have:

$$V = L \times B \times D.$$

The volume of displacement may then be expressed as a *percentage* of the volume V; this percentage varies for different classes of ships. In modern racing yachts with very deep keels the percentages vary from 22 to 33; in modern merchantmen the percentages frequently lie between 55 and 60; for ordinary small boats probably 50 will give a fair estimate. If the length is 20 feet, breadth 5 feet, and mean draught 2 feet, we have

$$20 \times 5 \times 2 = 200 \text{ cubic feet}$$

for the volume of the parallelopipedon; and

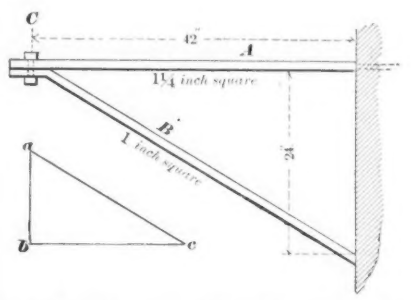
$$200 \times \frac{50}{100} = 100 \text{ cubic feet of displacement.}$$

There are 35 cubic feet of sea water to the ton; hence

$$\frac{100}{35} = 2.8 \text{ tons displacement.}$$

Of course this must be taken only as an approximate estimate. For an accurate computation we require the lines of the boat, and considerable labor will be involved. The registered tonnage is that which is of commercial value, and is found by the rules laid down in an act to regulate the admeasurement of tonnage of ships and vessels of the United States. You will find it in J. W. Nystrom's Pocket-book of Mechanics and Engineering.

(100) F. M., Knoxville, Tenn., writes: Kindly give me, through your columns, answers to the following questions: What load, using 10 as a factor of safety, can be carried by a bracket securely fastened to a wall? The dimensions of this bracket are shown in the figure. How is it figured out? *A.*—You do not say how the load is to be applied; we shall assume that it is uniformly distributed over the upper bar A, and that this bar is firmly fixed at both ends. The bending moment at the dangerous sections for a prismatic rectangular beam fixed at both ends, and a load uniformly distributed over its whole length, is $\frac{1}{12} W l$, in which W is the load in pounds; l the length in inches, in this case 42 inches. The resisting moment is $\frac{1}{6} S b d^2$, in which S is the stress per square inch on the fiber most remote from the neutral surface. For a factor of safety of 10 the value of S may be taken at 7,000; b the breadth, and d the depth of the beam, all in inches. This expression is true for all rectangular beams whose sides are vertical, whether the beam is fixed at one end, supported at its ends, or otherwise, and whether the beam be loaded at one point,



several points, or uniformly loaded. In a square beam, b is equal to d, consequently the resisting moment for a square beam will be $\frac{1}{6} S d^3$. Now, the bending moment is equal to the resisting moment, hence we have

$$\frac{1}{12} W l = \frac{1}{6} S d^3. \qquad (1)$$

The bar A is 1.25 inch square, hence $d^3 = 1.25 \times 1.25 \times 1.25 = 1.953125$, say 1.95. Substituting in formula (1) for the symbols their values we have

$$\frac{1}{12} \times W \times 42 = \frac{1}{6} \times 7{,}000 \times 1.95,$$

from which we get,

$$W = \frac{\frac{1}{6} \times 7{,}000 \times 1.95}{\frac{1}{12} \times 42} = \frac{2{,}275}{3.5} = 650$$

pounds. We may consider the strut B to be a pillar firmly fixed at both ends. Its length is, say, 47 inches. The load which will break a pillar of this size is found by the following formula:

$$P = \frac{36{,}000\ A}{1 + \frac{l^2}{3{,}000\ d^2}} \qquad (2)$$

in which P is the load in pounds; A the cross-sectional area in square inches of the pillar; in this case it is 1 square inch; l the length in inches, consequently $l^2 = 47 \times 47 = 2{,}209$; and d the side in inches, in this case 1 inch; the square of the side, or $d^2 = 1$. Now, substituting for the symbols in formula (2) their values, we have,

$$P = \frac{36{,}000 \times 1}{1 + \frac{2{,}209}{3{,}000 \times 1}} = \frac{36{,}000}{1.736} =$$

20,737 pounds, which is the breaking load. Using a factor of safety of 10, the load which the brace B can support will be 2,073.7 pounds. To find the compression in the strut B, due to the load W on the bar A, we proceed as follows: One-half of the load W is supported at C, hence the downward pressure at C will be $\frac{650}{2} = 325$ pounds. Draw the vertical line $a\ b$ to any scale to represent this pressure, let us adopt 100 pounds per inch, which will make the line $a\ b$ 3.25 inches long. Through a draw a line $a\ c$ parallel to the strut B; and through b draw $b\ c$ parallel to the bar A, meeting $a\ c$ in c. The line $a\ c$ measures 6.4 inches, hence the compression in the strut B, due to the downward pressure at C, will be $6.4 \times 100 = 640$ pounds, which shows that the strut B is strong enough to support the load W. 2. What size engine will be required to run three Gordon printing presses? *A.*—Write to the maker of the presses.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Grant's (1891) gear catalogue ready. See adv. p. 20.

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For a knowledge of blue printing write to D. R. Miller, architect, Harrisburg, Pa.

I. D. L. Drawing Stands. The original. For particulars and prices, address W. S. Rogers, Troy, N. Y.

Castings for small and medium-sized vertical engines. Humphrey's Foundry, Bellefontaine, Ohio.

Send to H. W. Knight & Son, Seneca Falls, N. Y., for catalogue of pattern letters and figures.

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For the latest improved Eccentric Hook, Connecting Rods and Stub Ends, address T. C. Dil-Machine Company, Philadelphia, Pa.

Hawkins' Calculations, for engineers, firemen and machinists. Send 25 cents for Part I, and subscription blank for whole issue, 10 parts (bound vol. $2.50). Theo. Audel & Co., 91 Liberty St., office 3.

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"Binders" for the American Machinist. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. American Machinist Publishing Co., 96 Fulton St., New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 53 East 10th St., New York.

MANUFACTURES.

Another cotton-mill may be erected at Americus, Ga.

Henry Turlington, Clinton, N. C., will erect a machine shop.

The Bowling Green (Ky.) Woolen-mills will enlarge their mill.

The Gainesville (Ga.) Iron Foundry is reported as to be enlarged.

The construction of a new furnace at Chattanooga, Tenn., is talked of.

The Salem Iron Works will, it is stated, erect new works at Salem, N. C.

A company is forming to build a $100,000 cotton factory at Cheraw, S. C.

Unarkam Bros. will, it is stated, erect an ice factory at Eufaula, Ala.

The establishment of a woolen mill is contemplated at Kerrville, Texas.

An electric light plant is rumored as to be erected at De Funiak Springs, Fla.

The erection of an ice factory at Morgan, Tex., will be commenced at once.

Johnson & Co. are reported as building new iron works at Manchester, Va

S. E. Cassino and others contemplate erecting a cotton-mill at Anniston, Ala.

G. H. Padrick contemplates the erection of an ice factory at Humphreys, Ga.

The car shops of Blaine Bros., at Green Cove Springs, Fla., are being enlarged.

The Triple Wire Nail Company of Parkersburg, W. Va., will erect a large factory.

A new roller-mill will be erected at Iowa Park, Tex. J. C. Flynn is the proprietor.

The H. O. Kerns iron foundry was recently destroyed by fire, at Sutherlands, Va.

The Middlebrook Cotton-mill Company will erect a cotton-mill in Newton, N. C.

A stock company has, it is stated, been organized to erect a cotton-mill in Newton, N. C.

The Peninsular Car Works, of Detroit, Mich., will probably be removed to Seattle, Wash.

The estate of F. W. Richardson, Troy, N. Y., has put on the market a model locomotive valve motion, by the use of which engineers and firemen can profitably study the distribution of steam in the cylinder.

A large steel plant may be built in South Bristol, Tenn., by a combination of corporations.

The Woodcock (Va.) Iron Works has been incorporated, with a capital stock of $20,000.

J. M. McCreary is reported as to erect an iron foundry and machine shop at Senola, Ga.

The Smith-Hill Company, Quincy, Ill., will build an addition to their extensive machine shops.

It is stated that the Berwick Car Works of Berwick, Pa., are to be removed to Bristol, Tenn.

Nelson Tift is corresponding with parties relative to the establishment of car works in Tifton, Ga.

The South Baltimore (Md.) Car Works will increase its capital stock from $200,000 to $300,000.

The erection of an ice factory is projected at Holly Springs, Miss. T. N. Walden is interested.

Parties are investigating with a view of establishing an iron and steel works in San Antonio, Tex.

It is stated that a chain factory is among the new enterprises contemplated at Pulaski City, Va.

A $250,000 cotton factory is reported as to be erected in the Saluda Valley, near Columbia, S. C.

New machinery will be shortly added to the Lead Hill Foundry and Machine Shops, at Lead Hill, Ark.

A northern syndicate is investigating with a view of establishing a cotton-mill in Baton Rouge, La.

The Wellman Iron and Steel Company, of Chester, Pa., will erect a steel foundry department, 100x300 feet.

The Jefferson (Texas) Woolen-mills Company is reported as to put new machinery in its woolen-mill.

A steel car works, to turn out from fifteen to twenty cars per day, is to be built near Des Moines, Iowa.

The Dayton Steel Chain Company, of Dayton, O., has been incorporated, with a capital stock of $15,000.

The Argonaut Cotton-mill Company, Covington, Ky., is to place $100,000 worth of new machinery in its mill.

The Manchester Manufacturing Company, of Macon, Ga., will put additional machinery in its cotton-mill.

The Watts Steel and Iron Syndicate is erecting an iron foundry and machine shop at Middlesborough, Ky.

The Adams Saw-mill Works, of Chattanooga, Tenn., are adding an iron foundry, machine and boiler shops.

Parties are investigating with a view of establishing an iron foundry and machine shops at Middlesborough, Ky.

A $125,000 stock company will be organized, to erect a cotton factory at Edgefield, S. C. G. B. Lake is interested.

The Michigan Railway Supply Company have commenced the erection of a large factory at Detroit, Mich.

A stock company, with a capital of $25,000, is building a brass foundry and machine shop at Middleville, Mich.

It is reported that the Gainesville Iron Works, at Gainesville, Texas, will be enlarged and new machinery added.

The Union Steel Works Company, whose works were burned out last fall, will establish a plant at Lexington, Va.

A Houston party is investigating with a view of establishing an iron foundry and machine shop at Yoakum, Texas.

George Baring and Oscar White are erecting and will operate an iron foundry and nail factory at St. John, N. B.

The Norfolk & Western Railroad Co. (office, Roanoke, Va.,) will, it is stated, erect repair shops at Hagerstown, Md.

A company with a capital stock of $50,000 is being organized at Greenwood, S. C., to erect machine and repair shops.

A company is organizing at San Antonio, Texas, for the purpose of establishing a steel and iron plant in that city.

A bill has been introduced in the legislature to incorporate the North Carolina Electric Power Company at Raleigh, N. C.

The Brush Electric Light and Power Company, Columbus, Ga., will, it is stated, put new machinery in its electric light plant.

The Buckeye Manufacturing Company, of Pittsburgh, Pa., employing 500 men, will locate at Stauffers, near Scottdale, Pa.

The Clover (S. C.) Cotton Manufacturing Company will put new machinery in its cotton-mill, and increase the capacity.

A $40,000 stock company will, it is reported, be organized to erect an ice factory and cold-storage warehouse at Baton Rouge, La.

At Sherman Heights, Texas, a company are reported as having purchased a site for the purpose of establishing a basic steel plant.

It is stated that the Reading Iron Works, of Reading, Pa., is investigating with a view of establishing iron works in Fort Worth, Texas.

The La Grange Compress Company, La Grange, Ga., has secured site and will shortly commence the erection of its cotton compress.

The North Baltimore Machine Works, of Notrh Baltimore, Ohio, will, it is stated, remove its machine works to Ronceverte, W. Va.

It is reported that Haselton, Pa., is to have a nail factory of $120,000 capital stock. It is to be established on the co-operative principle.

Lacroix Automatic Car Wheel Company, Chicago, Ill., with a capital of $100,000, has been incorporated by Frank H. Cooper and others.

Mr. Sprinkle and others are endeavoring to organize a stock company, to erect an iron foundry and machine shop at Corpus Christi, Texas.

The Ætna Iron and Steel Company of Bridgeport, Ohio, have under consideration plans for some extensive improvements and enlargements.

A northern syndicate has, it is stated, purchased the iron foundry of Benjamin Bowering, at Fredericksburg, Texas, and will operate same.

A new machine shop, 50x100 feet in dimensions, is being erected at Clarendon, Tex., by the Fort Worth & Denver City Railroad Company.

W. A. Cook, W. C. Foster, and F. H. Owens have incorporated the Foster Hardware Company, to manufacture hardware at Little Rock, Ark.

The Dustin Hardware Mfg. Company, Fort Payne, Ala., will meet on the 18th inst., to consider the feasibility of enlarging their machine works.

Thomas Bailey has, it is stated, purchased a half interest in the Lyndon foundry at Athens, Ga., and will put new machinery in and enlarge the works.

At Portland, Me., the Foster Machine Company, with a capital of $150,000, has been organized for the purpose of manufacturing textile machinery.

The Arcade Manufacturing Company, who will remove from Freeport to Madison, Ill., have increased their capital stock from $12,000 to $100,000.

The stockholders of the Owego Foundry and Malleable Works, Owego, N. Y., have decided to increase the capital stock and put in a malleable plant.

The Commonwealth Cotton Manufacturing Company, which will erect a cotton-mill at East Durham, N. C., has purchased a site in that place for $20,000.

There is water-works agitation in Whitefield, N. H.; Cheyenne, Wyo; Fairmount, Pa.; Pueblo, Colo.; Goffstown, N. H.; Tekamah, Neb.; Yonkers, N. Y.; Elkton, Md.

The Leonard Co-operative foundry plant, located at Taunton, Mass., has been sold to L. B. West for $9,000. The capital stock represented was $25,000 when at par.

The Golden Belt Manufacturing Company will, it is stated, put new machinery in, and double the capacity of its bag factory, which is located at Durham, N. C.

New machinery is to be added to the plant of the West Point (Ga.) Manufacturing Company, which will enable that mill to exceed 12,000 bales of cotton per year.

It is stated at Memphis, Tenn., that negotiations are pending between the Commercial Association and a car works company, for the establishment of a car plant at Memphis.

The Rice-Born Hardware Company, of New Orleans, La., has been incorporated, with a capital stock of $100,000, and will operate a factory in Texas, at Austin, Texas.

The Standard Spinning Company, of Wilmington, Del., will transfer its plant to Chester, Pa. A mill will be built on the line of the Baltimore & Ohio Railroad, to cost $40,000.

It is reported that contracts have been signed and all arrangements made for the erection of structural and galvanized iron works at Pulaski City, Va., with a capital of $200,000.

The Planters' Oil, Guano and Ice Company, Macon, Ga., will erect a cold storage warehouse and improve its ice factory, and is authorized to issue $25,000 of bonds for this purpose.

The Southern Steel Company, of Chattanooga, Tenn., are in the midst of preparations to equip their plant for the manufacture of forgings of every description from steel or iron.

A bill has been introduced in the legislature to incorporate the Alabama Locomotive Company, at Montgomery, Ala., with a capital stock of not less than $1,000,000, to establish car works.

The Attalla Foundry and Manufacturing Company, of Attalla, Ala., have increased their capital stock to $50,000, and will commence at once the erection of machine shops and a foundry.

The pipe works at Bessemer, Ala., are expected to start up about the first of March. They will employ about 800 hands to start with, and this number will be speedily increased to 1,000.

A new foundry is to be opened up at Bellville, Ill., by Messrs. Edward and George Rogers. The firm will do a general foundry business, but will make the manufacture of stoves a specialty.

M. C. Wolfe, T. F. McClure, J. A. Noon, and others have incorporated the Wolfe City Foundry Company, to erect and operate stove works, at Wolfe City, Texas. The capital stock is $50,000.

At Augusta., Ga., T. F. Warwick, H. C. Perkins, A. C. Brinson and others have incorporated the Warwick Machine Company, to erect iron and brass foundry and machine works; capital stock, $12,000.

A company, to be known as the Southern Farm Tool Company, has been organized at Atlanta, Ga., to manufacture, buy and sell machinery, implements, etc. The capital stock is placed at $100,000.

A party of eastern capitalists are endeavoring to organize a stock company, to erect a cotton-mill at Paris, Tex. Other parties are contemplating the building of a cotton seed oil-mill, at a cost of $125,000.

It is reported that another big machinery concern of Manchester, Eng., is looking for a location in Fall River, Mass. It is that controlled by Messrs. Greenwood, manufacturer of fine cards and other machinery.

It is stated that the Cambridge Roofing Company, of Cambridge, Ohio, has purchased a site, and will erect a branch roofing factory in Chattanooga, Tenn.; also that the company contemplates the erection of a rolling-mill.

The pipe manufacturing establishment of Shickle, Harrison & Howard, St. Louis, Mo., has erected branch works at Bessemer, Ala., which is turning out 200 tons of pipe per day. Its capacity is to be increased to 800 tons daily.

Rife Brothers will erect a large plant at Hazelwood, Pa., for the manufacture of wagon hardware. Ground has been bought for the new works, and construction will begin soon. From 75 to 100 men will be employed.

The $150,000 stock company recently reported as to remove a Newport (Ky.) rolling and muck-bar-mill to Salem, Va., has been organized by J. W. Womeldorf, of Cincinnati, Ohio, and J. J. Bright, of Point Pleasant, Ohio. Site for the plant has been secured.

At Savannah, Ga., S. G. Brosius, T. F. Stubbs, W. B. Stillwell and others, have incorporated the Brosius Rotary Engine Company, for the purpose of purchasing the patent right of the Brosius rotary engine, and manufacturing same; capital stock, $500,000.

The Adams Iron Company, of Pittsburgh, Pa., has been incorporated, with a capital stock of $200,000. The directors are George D. Blair, Thos. S. Blair, Jr., and F. Protzman. Works for making iron by the Adams direct process will be located at Glenwood, Pa.

E. Eastman, J. D. Collins, P. H. Harralson and others have incorporated the Chattahoochee Land Company, with a capital stock of $3,000,000. It is stated that this company has purchased 1,500 acres of land, and will build a new town near Atlanta, Ga., erect iron works, etc.

It is stated that a contract has been entered into with the Union Steel Works, of Louisville, Ky., manufacturers of edge tools, to locate their plant in Lexington, Va., at as early a day as possible. This company have a capital stock of $1,000,000, and the buildings will cover four acres of ground. They agree to work 300 skilled laborers.

It is stated, on what seems to be good authority, that the Ohio River Railroad will build shops, roundhouses, and terminal facilities at Central City, W. Va., midway between Huntington and Kenova. The Ohio River Company has been moving towards a continuance of its line to the southeast, and this statement shows that there is something of the sort in the way.

Notices have been posted in the mills of the Nashua (N. H.) Manufacturing Company and Jackson Company that the wages of the employes would be raised 5 per cent. This is a restoration of the cut-down of December, 1889, which caused the famous five weeks' strike, the most disastrous Nashua ever experienced. The advance affects over twenty-five hundred people.

The Maslin Machine Works, Jersey City, N. J., manufacturers of pulsometer pumps, special appliances for pulsometer pumps and general machinery, inform us that they are busy not only in supplying the trade with their general manufactured articles, but also in their special appliances for pulsometer pumps, by which they claim to increase both efficiency and capacity.

Adams & Marriott, of Kansas City, Mo., have made the citizens of Galveston, Texas, a proposition looking to the establishment of a rolling-mill in that place. A meeting of the business men of Galveston was recently held, at which these gentlemen presented a statement showing that bar-iron can be manufactured there 7¼ per cent. cheaper than at Pittsburgh, and 9.55 per cent. cheaper than in Philadelphia.

Glover Brothers, iron founders, at Frankford, Pa. have broken ground for a new plant, which will give employment to about 100 hands. They are to erect at once a brick building 52x120 feet, which will be divided into four large rooms, with a clearance of 16 feet from floor to beam. There will be a tumbling room, a finishing shop, a machine shop 30 feet square, and a two-story pattern loft 20x50 feet. The latest improved machinery is to be introduced.

Gould & Eberhardt, Newark, N. J., have received the following letter from a Russian customer: GENTLEMEN—It is long since I had the pleasure to correspond with you. Having promised to write you some day how your tools were doing their duty, I do so now, finding the opportunity a good one, for the reason that a long and thorough trial was given the machines. Now, I can say so with some authority; it is a positive fact that the machines, both gear cutter and drill press, are behaving splendidly, giving perfect satisfaction; in fact, I could not do without them anyhow. There was some trouble with the gear cutter at first, not in attending it, however, but mainly in the fact that the machine was not adapted to carry cutters 1¾ and above diameter, which is the size of B. & S. cutters from 24 to 48 pitch; moreover, the rack cutting attachment would not admit anything approaching this size, hence considerable annoyance. All this, however, is changed now, to my complete satisfaction. The improvement necessitated some thought and time to be expended, but I am amply repaid by the results obtained. In your country I feel sure a patent would have been obtained for above improvement, or at any rate applied for. But enough about that; sufficient to say that I am cutting both gears and racks 2 to 48 pitch, the necessary change being allowed without any other change being made, but the fixing of the chuck; a hoist is provided for this purpose, by which arrangement much is gained in time. I saw at the World's Fair in Paris one of your gear cutters, as made by Steinlen & Co., of Mulhouse, Alsace. I do not know whether you made any arrangements with the firm for the production of these machines, but can only testify to the truly wonderful excellence of workmanship displayed by the makers. Being a reader of the AMERICAN MACHINIST, I got, of course, some information now and then concerning the new tools you put on the market, feeling duly interested in the matter; I take this opportunity of requesting you to send me photos or cuts of your latest machines and attachments, and to quote me corresponding prices thereon. Trusting you will kindly comply with this request of mine, I am, very respectfully yours, NICHOLAS L. SHABELSKY. P. S.—I was forgetting to state one very important point, viz., should you again send me any machinery, my first condition will be to have the same packed in as *many* cases as possible. This will, of course, cause some surprise in America, but you must take into account that facilities for handling a box weighing say 10 tons are not the same in every country. To make the matter more clear, I will say that your machinery was injured to some extent by the rough handling it was subject to; in fact, it was a matter of wonder it was not completely ruined, there being generally a lack of cranes in our country, and, what is worse, of care, too; if you write "This side up," rest assured it will be down.

Some Notes on Fans.

BY W. H. BOOTH.

An air fan, like a water fan, which is usually termed a centrifugal pump, works by centrifugal action. The blades of the fan push air around in a casing more or less eccentrically placed, with respect to the revolving part, and, like any other ponderable body, air revolving about a center tends to leave the circular path tangentially. If an opening be made in the enclosing case, air will escape at such opening with a force commensurate with the velocity of rotation of the fan. In an actual fan such outlet is provided at a tangent to the casing circumference, and forms the delivering pipe. A casual or superficial observer would be very apt to conclude that if the outlet were to be stopped up the fan would be choked, and require an immense amount of extra turning. As a fact, such is not the case. When choked, a fan with its contained air simply revolves as a cylinder, the spaces between the fan arms being simply full of air, which has no means of moving away, and the only resistance to rotation is that due to the friction of the revolving air upon the casing. As soon, however, as the outlet is opened, air begins to escape at a high velocity; its place is filled by more air entering by the central eye or inlet, which air has, in turn, imparted to it the tip velocity of the fan, and so the process continues as long as the outlet is kept open.

If a fan be driven by an engine, the governor of which is out of gear, it will at once be seen that closing the air outlet will cause the engine to run away; or, if the engine be run at the desired speed, with the fan outlet shut, it will at once run slow when the outlet is opened. This is because the opening of the outlet allows work to be done in moving a volume of air, the work thus done being greater than that due to simply churning up a casing full of air.

The efficiency of a fan, or rather the effect of a fan, is dependent upon its velocity of rotation, and it will not do to do the work of a small fan by means of a large one at a slow speed, unless such work be simply the changing of a large volume of air at atmospheric pressure, *i. e.*, with inlets and outlets to the building or room through which the air has to pass, of a size sufficient to prevent any appreciable increment of pressure anywhere.

What is specially referred to above is furnace work. A large fan, sufficiently large to supply, say, six furnaces, is made to work two furnaces only. It would be a mistake to run this fan any slower than at its designed speed for six fires, under the impres-

sion that the smaller quantity of air warranted a lower speed, for such is by no means the case. If the fan needs to run at 1,000 revolutions for six fires, it must run equally fast for two, or even one; for if it did not so run, the air supplied by it, no matter how sufficient in volume, will be wholly deficient in pressure. The fan must be geared up at once for its maximum speed, and furnace after furnace can be added to it until all the air volume which can be supplied is taken up.

A large six-furnace fan, run at two-thirds speed, utterly failed to keep two furnaces in good order, though it showed itself capable of discharging an enormously excessive volume of air at an open-end pipe. Clearly, then, it is bad economy, or no economy at all, to run a fan of larger than needful size. It should be no larger than sufficient to turn out the necessary volume of air, and its speed must be such as to maintain the pressure. A fan too large, and run at the speed necessary, is simply a waster of power in friction, though not to the extent that might be expected. To clearly understand this, it is necessary only to bear in mind that, like its fellow, the centrifugal pump, it depends wholly on centrifugal action. A pump which, at 1,000 revolutions, would just raise water 50 feet, could not raise any water to the same height at 900 revolutions, whereas a steam engine, driving a geared pump of the piston type, could do work proportional to its speed of rotation with suitable connecting gears.

In applying fans to furnace blowing it would, of course, be quite possible to use slow-speed fans, delivering large volumes of air at a low pressure, if it were possible also to preserve an evenly thin fire.

In practice, such is not possible, and to prevent useless air rushing through thin places the fires are made thick, and thin places form less readily and more easily tend to make up again. Consequently, the blast intensity has to be such as can cope with a thick fire, and so the fan must run fast to give the pressure required; and when so worked, it seems best so to proportion the openings of the air or blast gates, and of the damper behind the boiler, that the flames shall show an uncertainty as to whether they should pour out at the furnace door, when this is opened, or not. With a plain plate door, say $\frac{3}{8}$" thick, it is well that this should attain a dull red heat. Any opening of the damper ought properly to be accompanied by an opening of the blast gates also, so as to preserve the above tendency of the flumes, and the reduction of the call for steam should also equally close both blast gates and damper.

In no system of working is it more important to prevent thin places in the fires, or to prevent thin places admitting enormous volumes of cold air. The above method of pressure working over the fire is a great safeguard. Also, as already pointed out in the columns of the AMERICAN MACHINIST, the closing of the damper brings up the pressure in the brickwork flues to that of the external atmosphere, and so avoids the percolation of air through every pore in the brickwork, every faulty mortar joint or other opening, and cannot but fail to be beneficial.

When ordinary draft and forced draft boilers work together, there is considerable trouble in arranging matters permanently. The movement of the main damper for the ordinary furnaces destroys the balance of the forced draft furnaces, and heat that should be gotten by the fires seems to generate in the tempers of the men in charge.

About two weeks previous to the date of this paper the American flag was liberally displayed in New York city in honor of the one hundredth anniversary of the birth of Peter Cooper, that grand philanthropist. Warriors and statesmen may need monuments to recall to posterity the memory of their deeds. Peter Cooper has left, in Cooper Union, a monument far more expressive than any ever hewn from granite or marble. All over the country are those who have enjoyed the advantages of the schools he founded, and who remember with gratitude the great-hearted, unselfish founder. Undoubtedly there will, and ought to be, a monument erected to Peter Cooper. But it can never rival Cooper Union.

Adjustable End-thrust Bearings—Turning Ball Surfaces.

BY S. W. BALCH.

A self-aligning bearing, with adjustable provision for end-thrust, was desired by the writer to meet the following conditions: The thrust was liable to be in either direction, and adjustable means were needed to meet it. Severe strains, introduced when the machine is at work, tend to throw the bearings out of line. The frame *A*, Fig. 1,

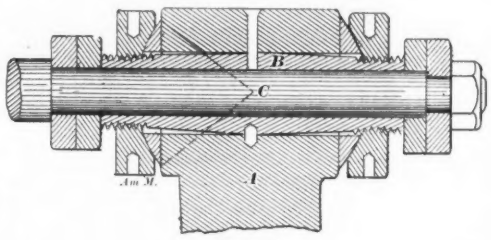


Fig. 1.

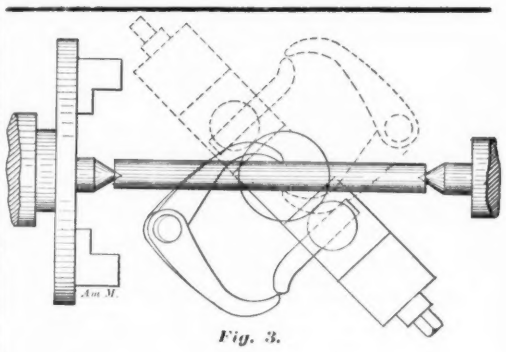


Fig. 3.

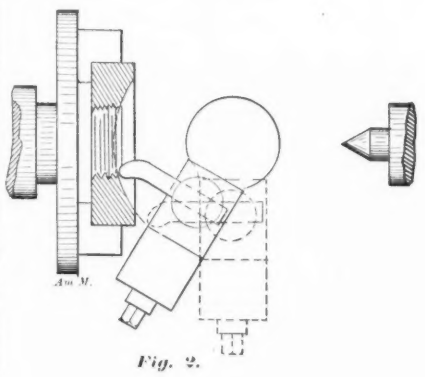


Fig. 2.

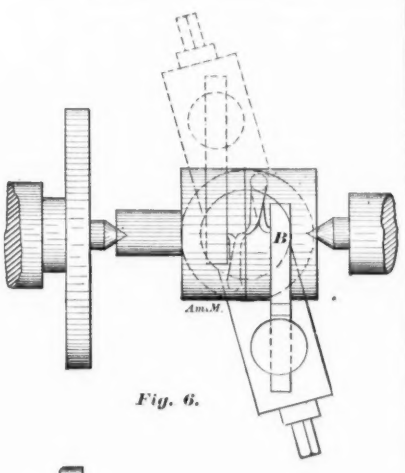


Fig. 6.

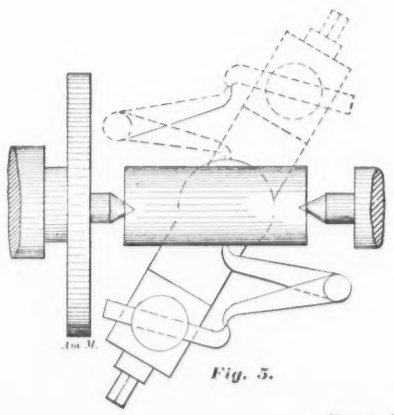


Fig. 5.

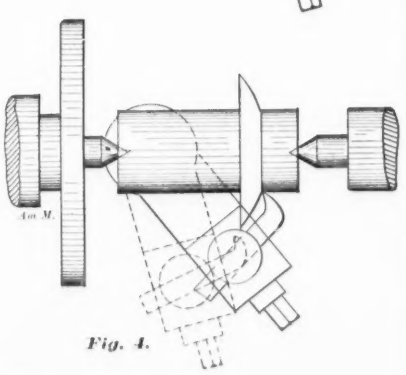


Fig. 4.

BALL BEARINGS.

supports the bush *B*, in which the shaft revolves. This bush is turned crowning, so as to bear against the hole in the frame only at the center, so as to be in perfect line with the shaft, though the bore in the frame may not be true. As the collars which receive the end thrust abut against the ends of the bush, the effect of this pressure would be to square the nuts *N* against the faced ends of the frame, and destroy the value of the above construction, permitting the bush to align with the shaft, but for special provision. This provision consists in providing washers with ball surfaces, against which the nuts press, instead of against the squared ends of the frame. These ball surfaces have a common center at the center of the bearing at *C*. Ball bearings, similar to those described in the AMERICAN MACHINIST, April 3, last year, may be advantageously substituted for the collars to reduce the friction.

The use of ball surfaces in the above construction introduces the subject of turning spherical surfaces without special fixtures. In every well-equipped shop we may expect to find a lathe with a compound tool slide for feeding the tool on the angle. Such a lathe will answer our purpose for turning balls and sockets by revolving the compound slide on its swivel. But to turn them properly in this way, the swivel must be brought exactly under the axis of the lathe before the work is commenced, and not shifted from this position during the turning.

Three cases are likely to arise, requiring different methods of proceeding. First, turning a socket; second, turning a portion of a ball, not of sufficient extent to admit of the size of the ball being calipered; third, turning a ball whose diameter can be tested with the calipers.

The first case is shown in Figs. 2 and 3. First set up the lathe approximately. Bring the swivel of the compound slide as nearly as possible under the point where the center of the socket will fall when the work is chucked. Set the compound slide and the tool so that it will be apparent that the latter will reach to do the work without the compound slide being swung into interference with the chuck. Next put a mandrel in the lathe and open your calipers to the radius of the socket you wish to turn, plus half the diameter of the mandrel. The shank of the tail-stock will answer in place of the mandrel if you are certain that it is in line with the spindle of the lathe. Next bring the tool—by swinging the compound rest, and turning its feed screw—to the position shown in Fig. 3. Remove the mandrel, swing the compound rest to the dotted position, replace the mandrel, and try the calipers. Correct half the error with the cross-feed, and the rest with the screw of the compound slide. Repeat this until the calipering is correct on each side. Now clamp both the cross and the compound slides, and return to the position shown in Fig. 2, bringing the tool to its work by sliding the carriage on its ways, and feeding the tool by turning the compound slide on its swivel, and work out the socket to the depth called for.

The second case, facing a ball surface, is shown in Figs. 4 and 5. The operation is similar to the above, except that inside calipers are used and set to the radius of the ball, minus half the diameter of the mandrel.

If the tool is removed for grinding in either of the above cases, the calipering will need to be done over again when it is replaced, but only the compound slide will require shifting.

The third case in which the ball can be tested with the calipers is in some respects simpler, and in some more difficult, than either of the preceding cases. In the former cases the carriage slide was the last to be set and the tool the first. In this case the carriage is the first to be set and the tool the last. The work is turned to the diameter that the ball is to be, and the center line marked. A bar *B*, Fig. 6, bent so as to reach over the top of the work, is first clamped in the tool-post, and the carriage shifted on its ways till the swinging of the compound slide between the two positions shown carries the bent bar to equal distances either side of the center line scored on the work. When this is done the carriage is locked on its ways. The swivel is next centered with the axis of the lathe as in the preceding cases, but it will not be necessary to set the calipers to any particular distance. Having set the carriage on its ways, and the cross-slide in its place by these two adjustments, the tool is set in its post any way so that it will cut properly, and can be carried across the ball by swinging the compound slide without meeting with any interference. The tool in this case is brought up to the work by turning the screw of the compound slide, and the ball is calipered for size as the work progresses.

The common and necessary operation of sweeping the floor of a school-room, factory, or other large apartment, is generally carried out with great inconvenience to the sweepers, and with the result that a large proportion of the dust removed from the ground is transferred to every object in the room where it can find a resting place. The air, too, is contaminated for a long time afterward with floating particles, which are very distressing to those who have to breathe in it. All this can be avoided by dispensing with the common practice of sprinkling the floor with water previous to the use of the broom, and by applying the moisture in a different way. By laying a line of wet sawdust right across one end of the apartment, and by sweeping it foot by foot to the other end, it will, in its passage, lick up every bit of dust without raising any in the air. By adding to the wet sawdust a small proportion of any disinfectant, it is obvious that the cleaning will be still more effectual. —*Chambers' Journal.*

An expert in such matters says he has found the following the best thing he has tried for making joints against fluid pressure:

5 pounds Paris white.
5 pounds yellow ochre.
10 pounds litharge.
5 pounds red lead.
4 pounds black oxide manganese.

The whole is to be well mixed, and a little asbestos and boiled oil added. This, he says, soon becomes nearly as hard as the iron itself.

Engineering announces the death, at Cologne, of Dr. N. August Otto, the inventor of the Otto gas engine, which took place January 26. Dr. Otto was not trained as an engineer, but, by hard study and application, made himself one, and was successful, besides being an honorable man, highly esteemed by all who knew him.

There is strong agitation in Texas in favor of a law requiring workmen to be paid weekly. It appears to be a move against the store system.

Machinists' Supplies and Iron.

NEW YORK, February 19, 1891.

Iron—American Pig—The increased demand, together with the coke strike, which seems likely to limit production for some time, have caused a condition favorable to sellers, who now seem to show little anxiety to sell, even at the advanced quotations.

We quote No. 1 Foundry, standard Northern brands, $16.50 to $17.50; No. 2, $15.75 to $17; Gray Forge, $14.25 to $15; Southern brands No. 1 Foundry, $16 to $17; No. 2, $15.50 to $16.25; No. 3, $14 to $14.50.

Scotch Pig—The market continues dull.

We quote Coltness, $24.50; Dalmellington, $22 to $23, and Eglinton, $20.50.

Copper—The Lake companies quote 15c., though plenty of Lake can be had at 14½c., and there are rumors of sales at 14¼c. Casting copper is held at 12c., though somewhat lower figures are said to have been accepted. Arizona Ingot is held at 12¾c. to 13c.

Lead—The market is dull and prices are somewhat lower. In car load lots it can be had for immediate delivery at 4.30c.

Spelter—The market is very quiet, and buyers seem to expect lower prices. Values range at about 5c.

Tin—Not much is being done, though prices are steadily maintained. Values range at 19.25c. to 20.20c.

Antimony—Prices of leading brands are somewhat lower.

✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Wanted—Man thoroughly acquainted with hydraulic work, that can influence trade. S. H., 245 N. J. R. R. ave., Newark, N. J.

Wanted—At once a number of good machinists on new and repair work. Beall Machine Shops, Cumberland, Md.

Wanted—Wood pattern maker whose experience has been largely with steam fittings. Illinois Malleable Iron Co., Chicago, Ill.

Wanted—By first-class machinist a position as foreman of shop. Five years experience; good references. Address Box 52, AMERICAN MACHINIST.

Machinery moulders wanted; wages two dollars and fifty cents to three dollars per day. Ottumwa Iron Works, Ottumwa, Iowa.

A compt engineer wants position with stationary, loco. or steamboat engineer. Cert. and ref. given. Larson, 2224 Callowhill street, Philadelphia, Pa.

Wanted—An assistant manager in a large machine shop. A graduate of scientific school preferred; give particulars. O. L. R., AMERICAN MACHINIST.

Machinist, a good general workman, sober, industrious, and a worker, wants a change May 1, 1891. Webster, AMERICAN MACHINIST.

Draftsman wanted for machine shop in Brooklyn. State experience, age, and salary expected. Address P. O. B. 1805, New York.

Wanted—Foreman for iron foundry running 60 molders on pipe fittings and valves. Address, giving references, and salary required. Box 50, AM. MACHINIST.

Wanted—Two mechanical draftsmen, capable of making neat, accurate drawings; a good opportunity for young men desiring experience. Address T. R. Browne, No. 1,110 Twelfth avenue, Altoona, Pa.

Wanted—A practical man familiar with designing and manufacturing duplex pumps and boiler feeders, as superintendent in a new factory to be started in Illinois. Address with refs., Duplex, AM. MACH.

Wanted—A first-class foundry foreman, to take charge of a shop running from 10 to 15 molders on engines and heavy machinery; give references. Address Box 55, AMERICAN MACHINIST.

Wanted by a machine shop foreman of well-recognized ability as a manager of men, practical, reliable, and a hustler, a change. New England location preferred. Johnstone, AM. MACHINIST.

Draftsman experienced on machine tools and punching machinery desires to change location; pattern maker by trade, and has held positions in drawing-rooms of large shops making above machinery. Address Tools, AMERICAN MACHINIST.

Wanted—A first-class practical draftsman. One who is well up in modern stationary and marine engine and boiler work can secure a steady situation. Address, stating age, exp., ref., and wages desired, Moran Bros. Co., Seattle, Washington.

Wanted—A general foreman for a Western manufacturing company; one familiar with steam fitters' supplies preferred; must be well posted in iron-working mach'y, & fully competent to handle men advantageously. Address Box 49, AM. MACHINIST.

A machinist of good education and knowledge of steam economy, lately traveling for a firm building machine tools, wants a position as traveling salesman to sell engines or other machinery. Address Box 57, AMERICAN MACHINIST.

Wanted—A number of first-class machinists to work on ice and refrigerating machinery, and stationary engines; good wages and steady work to first-class men. Address Frick Company, Waynesboro, Franklin County, Pa.

Wanted—A first-class boiler maker; one who understands the construction of Marine and Land Boilers; must have first-class recommendations; such a man may obtain a good situation by addressing G.W.Hume Craig, 110 E. Lexington st., Balto., Md.

Wanted—A good tool maker for a shop making a line of fine brass work. An experienced man who has a good record will find this a permanent place in a good shop. Address, with references, Phila., AMERICAN MACHINIST.

Wanted—Foreman of machine shop, of experience and ability in handling heavy and light general work. Friction clutch pulleys and couplings a specialty. Send references, and state salary expected, at once. Address Box 53, AMERICAN MACHINIST.

Position of responsibility wanted by a first-class machinist and tool maker in a shop manufacturing some specialty similar to small arms, sewing machines or type writers. Best references as to ability and character. Box 58, AM. MACHINIST.

Wanted—Situation as foundry foreman or superintendent of a manufacturing concern, by an experienced man who is prepared to furnish the highest references as to character and ability. Middle or Eastern States preferred. Address Box 48, AM. MACHINIST.

A practical mechanical engineer, 29 years experience in shop, drawing office, and as supt., thoroughly acquainted with steam engines, boilers, machine tools, and other specialties, millwright work and general machine shop practice, seeks a responsible position; unexceptionable ref. Dixon, AM. MACH.

Wanted—A position as supt. of works in engine or general machinery line; am familiar with high-speed and Corliss automatic engines, and water-works machinery; a first-class draftsman, and used to handling men; do not want any glory, but expect to give an equivalent for a good salary. Address O. K., care AM. MACHINIST.

Wanted—A foreman in a jobbing foundry employing from 6 to 15 men in western Illinois. Should be acquainted with general machine and architectural iron castings; a first-class man can secure a desirable situation and interest in company; state age, experience, and wages expected. Address Box 54, AMERICAN MACHINIST.

A pushing, practical foundry foreman with good executive ability in handling work and men, well up in mixing and melting metals, core making and general foundry knowledge, wants position; engine work or heavy machinery preferred. American, temperate, age 36, references A 1. Address Box 56, AMERICAN MACHINIST.

Superintendent—A thoroughly practical machinist and iron founder with twenty-three years experience as apprentice, journeyman, foreman and superintendent, now in charge of one of the best plants in the country, wishes to make a change during the coming spring. The very best of references as to character and mechanical and executive ability; salary moderate and according to the responsibility. Address Maxwell, AMERICAN MACHINIST.

Wanted—A young technical graduate, having had at least two and a half years' practical work in a good machine shop; must be of undoubted integrity, and well recommended, vigorous, and willing to do anything required in the line of office-work, drafting, or shop-work. The right person can identify himself with a growing machine business in the West; wages will be moderate at first. Address Y. T. G., AM. MACHINIST.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Cheap 2d hd-lathes & planers. S. M. York, Clev'd, O.

Just out: aluminum steel hack-saws, hard but not brittle. Crescent Mfg. Co., Cleveland, Ohio.

New catalogue of engineers' specialties free. Crescent Mfg. Co., Cleveland, Ohio.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Wanted—Customers for our new Radial Drills. C. H. Baush & Sons, Holyoke, Mass.

Wanted—Specialties for the Southern trade. Bluefield Iron Works, Bluefield, W. Va.

Engineers wanted to send their addresses and receive free a 25 cent book, "Hints and Suggestions for Steam Users." Lord & Co., P. O. Box 1262, Phila., Pa.

Wanted—Correspondence with parties having machine tools to sell. Address Expert, 424 North 14th street, Richmond, Ind.

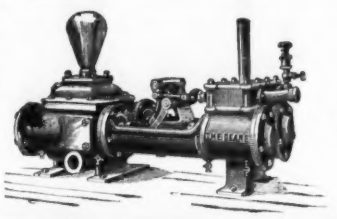
Pulsomer Pumps—Several sizes, nearly new, cheap; 8 horse-power Lidgerwood hoister, large water motor, exch'g. 165 First st., Jersey City, N. J.

For Sale—A foundry and machine shop in a growing western town doing a good business; splendid chance for a molder and machinist with small capital. Address Box 38, AMERICAN MACHINIST.

Wanted—Engineers to write for catalogue of all the latest and most valuable mechanical, scientific and electrical books which are given free with each barrel of the Pittsburgh Boiler Scale Resolvent. Pittsburgh Boiler Scale Resolvent Co., Pittsb'gh, Pa.

Wanted—To buy 2d hand mach. tools in good condition as follows: One 22″x22″x6′ planer; one 24″x8′ engine lathe; one 14″x6′ engine lathe; one milling mach., universal, size Brainard No. 3; one 10″ or 12″ shaper; one 18″ upright drill. State maker's name, and terms, and address Buyer, AMERICAN MACHINIST.

For sale—One set of Whitworth's taps and reamers, comprising sizes 5/8, 11/16, 3/4, 13/16, 7/8, 15/16, 1, 1 1/16, 1 1/4, 1 3/16, and 1 1/16″ diameter. There are three assorted taps, and one master tap; and one taper and one straight reamer to each dimension. This set has never been used, and cost $250. We will sell at a sacrifice for $125. Frasse & Co., 92 Park row, N. Y.



THE DEANE
OF HOLYOKE
STEAM PUMPS
DEANE STEAM PUMP CO.,
HOLYOKE, MASS.

Makers of
CRESCENT STEEL CO.
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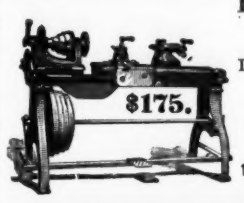

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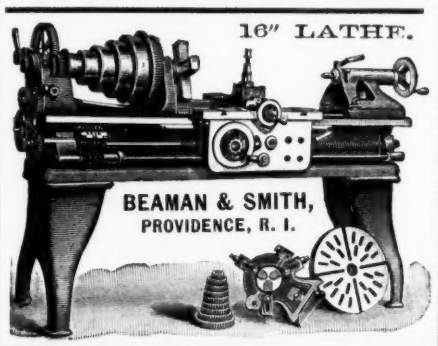

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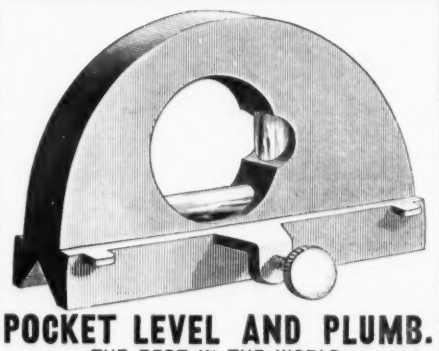

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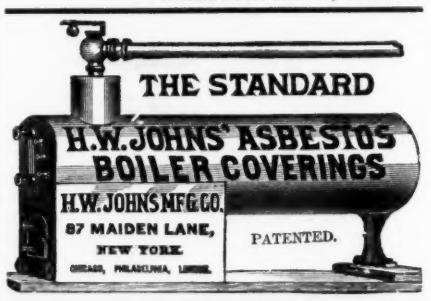

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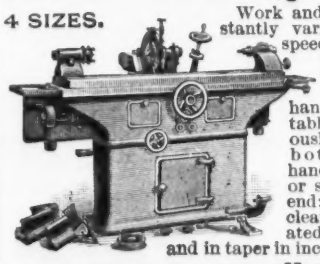

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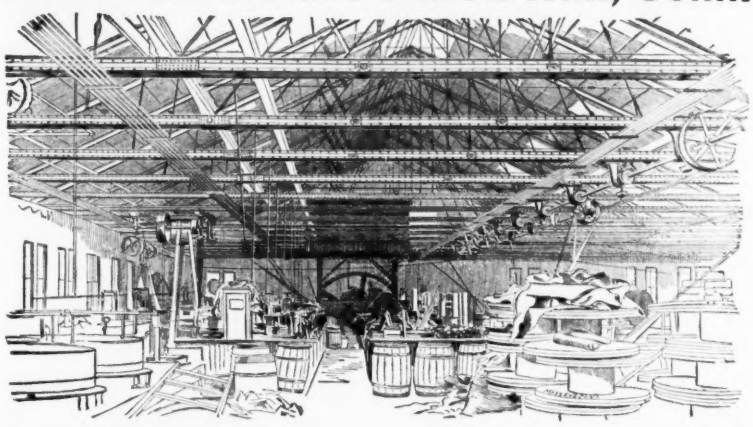

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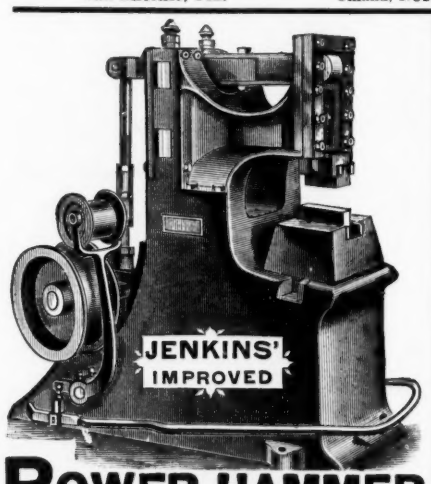

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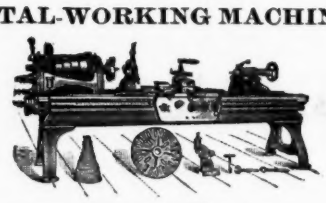

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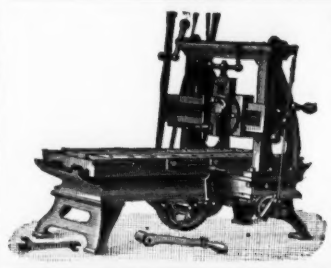

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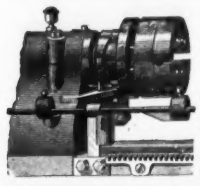
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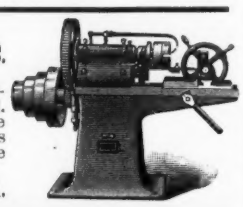

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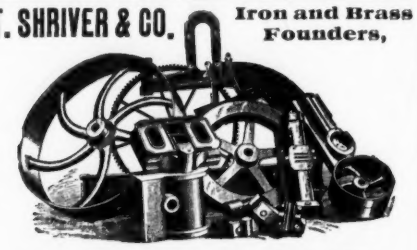
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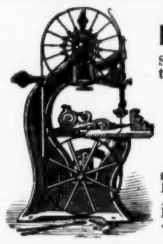
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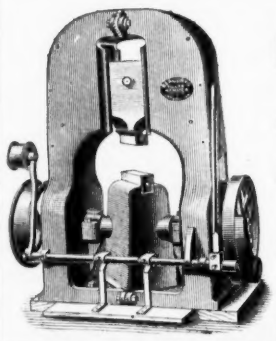
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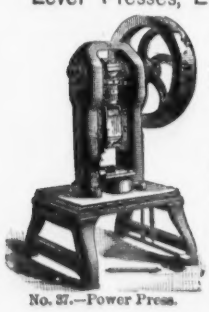
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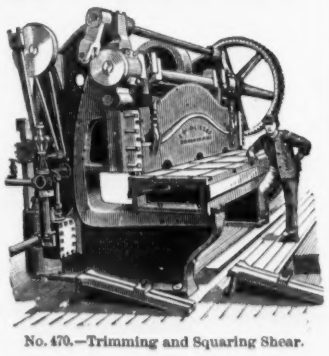
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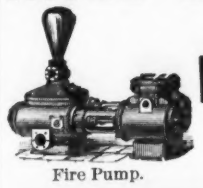
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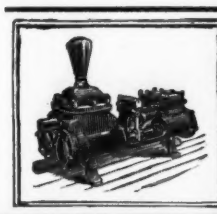
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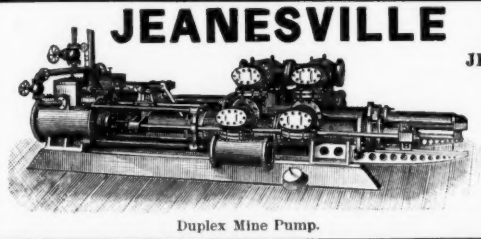
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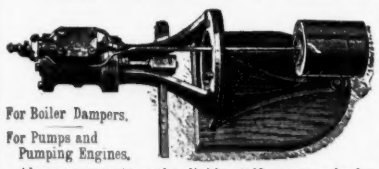
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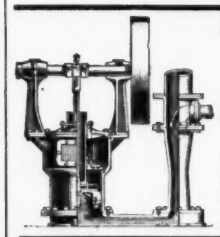
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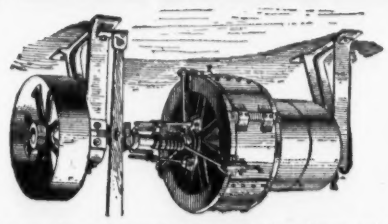
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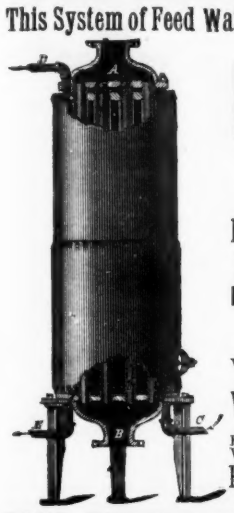

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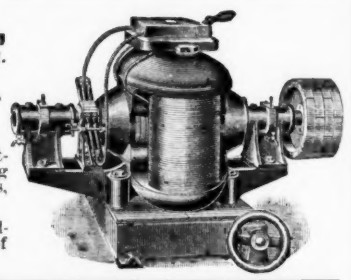

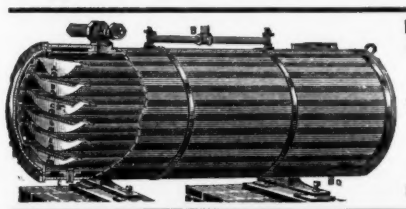

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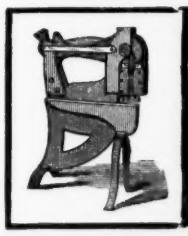

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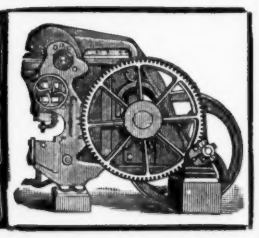

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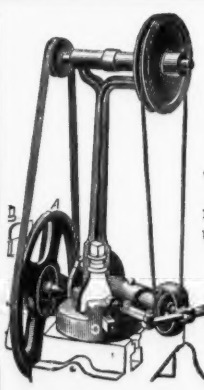

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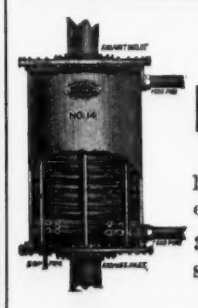

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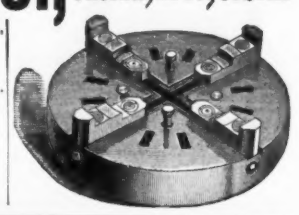

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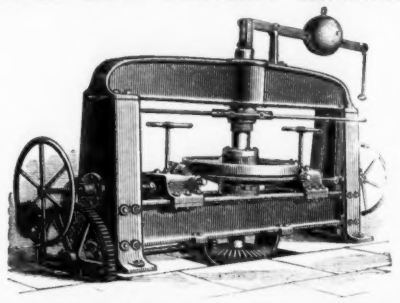

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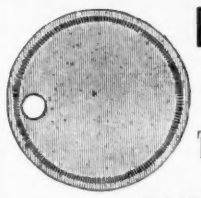

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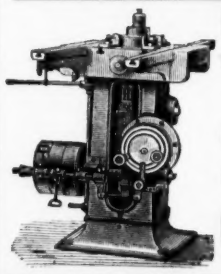

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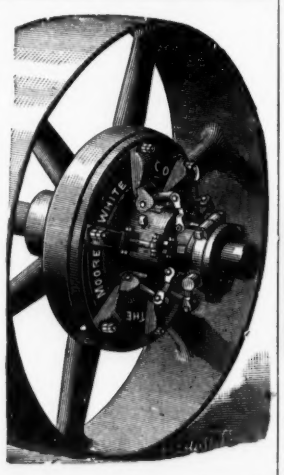

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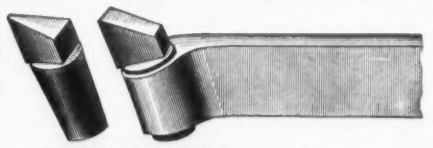

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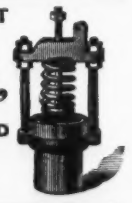

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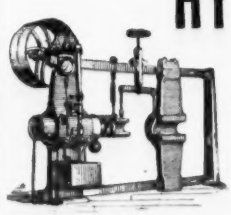

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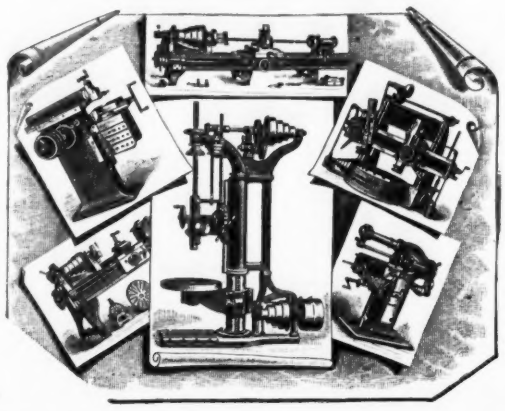

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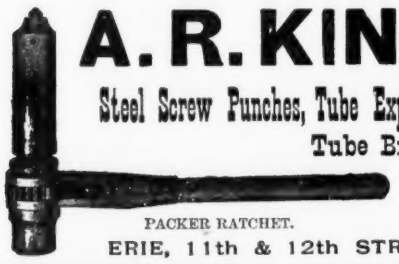

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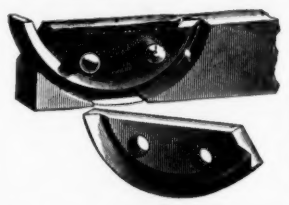

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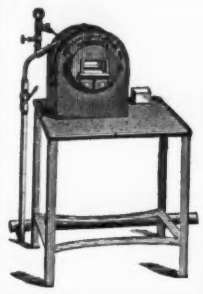

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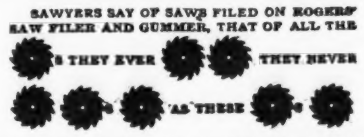

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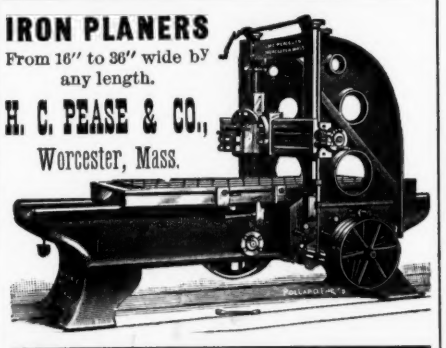

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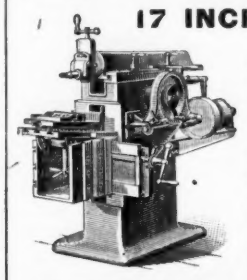

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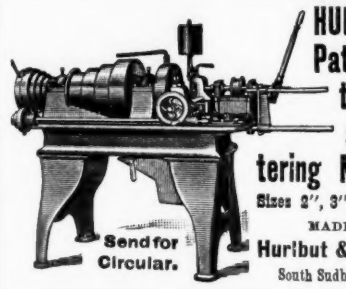

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Metal guaranteed to be equal in quality to the best metal manufactured by any other process.

Prices on sheets, wire, tubes or castings, given upon application.

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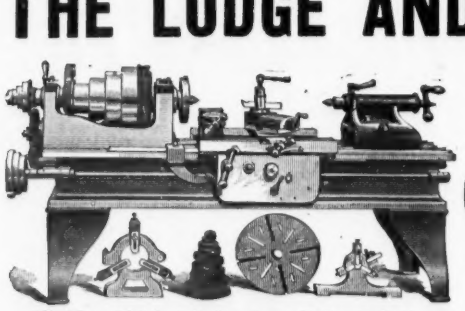
ENGRAVER ON WOOD
58 ANN ST. NEW YORK.

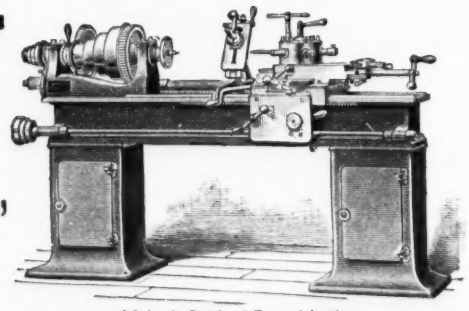
THE LODGE AND DAVIS MACHINE TOOL CO.

Works, CINCINNATI, OHIO.



EASTERN HOUSE:
64 Cortlandt St.,
NEW YORK.

WESTERN HOUSE:
68 & 70 S. Canal St.,
CHICAGO.

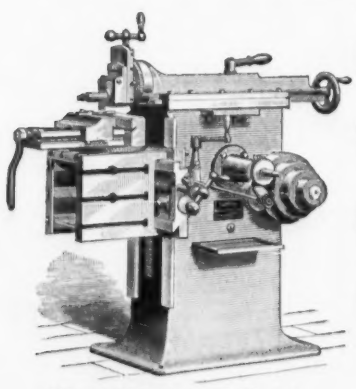


17, 19 and 21-inch Swing, Large Hollow Spindle.
Taper Attachment, Automatic Stop, Compound Rest, Lead Screw, under front V. All feeds reversed in apron. Extra heavy, Convenient, and easily handled.

24, 27, 32 and 38-inch Swing, Cabinet Legs.

18-inch Cabinet Turret Lathe.
Taper Attachment, Automatic Feed, Lever and Screw Movement, most complete brass lathe on the market.

COMPLETE MACHINE SHOP EQUIPMENTS A SPECIALTY.



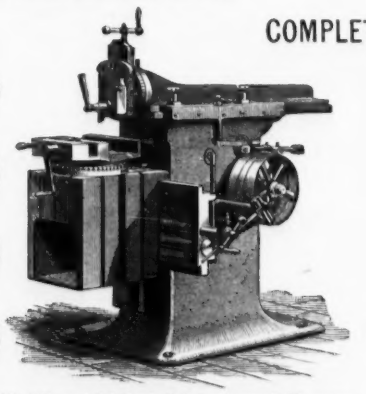
ENGINE LATHES

TURRET LATHES

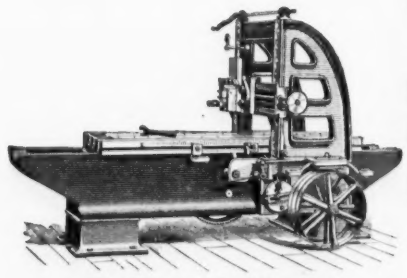
IRON PLANERS

PULLEY LATHES

15 and 20-inch Crank Shaper.
Stroke changed and adjusted while running. Stroke at all times positive. Invariably plane to a line. Detachable Tables.



20, 26 and 32-inch Triple Geared Shapers.
Stroke changed while machine is running. Shaft can be passed through head of machine and key seat cut in same to any length. Extra heavy vises. Tables slotted on all sides.

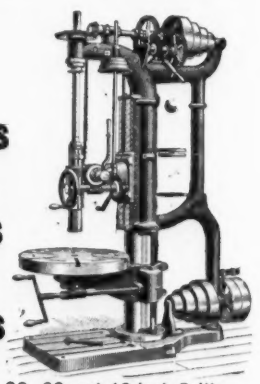


24, 32 and 36-inch Planers.
Extra deep beds and tables. Powerfully geared. Plenty of Metal and designed for extra heavy duty. All Feeds and Shipper operated from both sides.
Improved device for holding Planer Bolts.

DRILL PRESSES

MILLING MACHINES

IRON SHAPERS



25, 28, 32 and 40-inch Drills.
Automatic stop to feed. Quick return on right side. Table operated from front. Large cones and long belts.

NEW ENGLAND AGENTS,
THE C. & F. MACHINE TOOL CO., BOSTON, MASS.

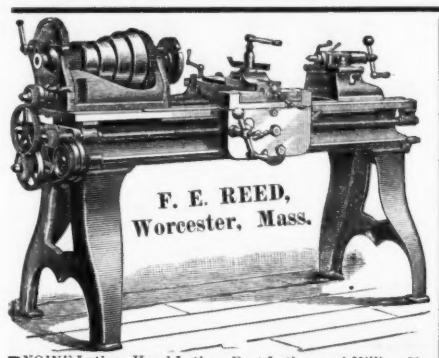
SOLE AGENT FOR GREAT BR TAIN,
ALFRED HERBERT, COVENTRY ENGLAND.

See advertisement on page 20.

MORSE TWIST DRILL AND MACHINE COMPANY, New Bedford,

Manufacturers of Morse Patent Straight-Lip Increase Twist Drills.

Solid and Shell Reamers, Beach's Patent Self-Centering Chuck, Bit Stock Drills.
DRILL GRINDING MACHINES, MILLING CUTTERS AND SPECIAL TOOLS TO ORDER.



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FLATHER ENGINE LATHES

14, 15, 16, 18, 20, 24 and 28 INCH SWING.
ANY LENGTH OF BED DESIRED.

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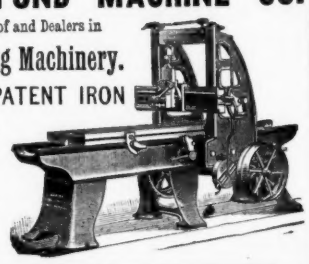
Manufacturers of and Dealers in
Iron Working Machinery.
IMPROVED PATENT IRON PLANERS A SPECIALTY.
152 Union St., WORCESTER, MASS.



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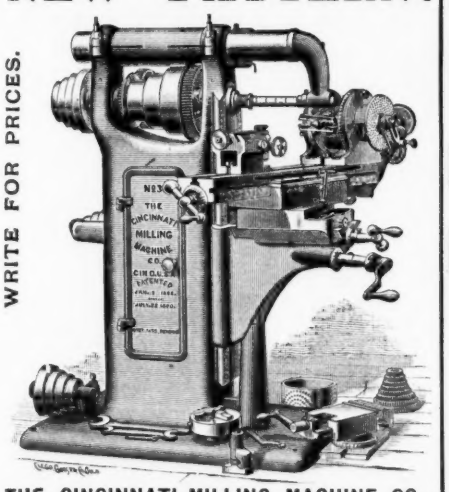

THE CINCINNATI MILLING MACHINE CO.,
SECOND & PLUM STS., CINCINNATI, O.

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15" and 18" Crank } SHAPERS.
20" and 26" Geared }
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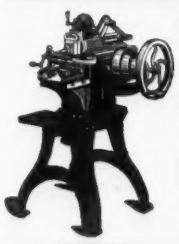

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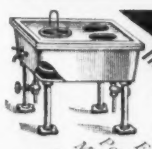
WORCESTER, MASS.
Manufacturers of
Shaping Machines,
Drilling Machines,
Bolt Cutting Machines.
Send for Catalogue.



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Improved Steam Glue Heaters
without Joints, and therefore free from leakage. Furnished with plain iron, Enameled Iron or Copper Pots. For Pattern Makers, Cabinet Makers, Joiners, Bookbinders, in fact, all who use Glue. Please mention this paper, and send for Price List to makers. Made in nineteen different styles.

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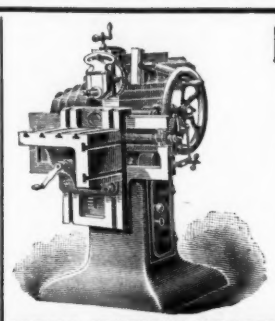

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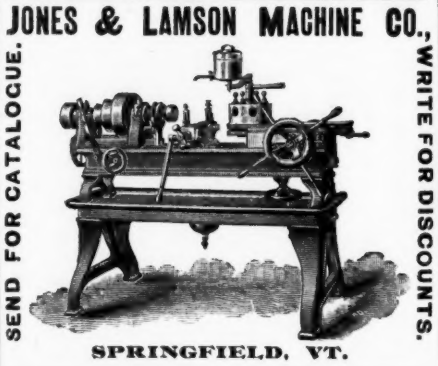

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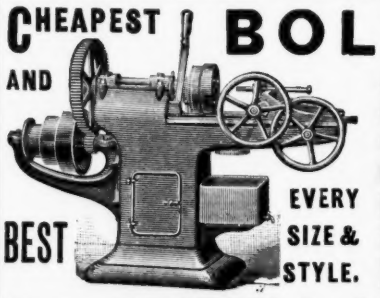

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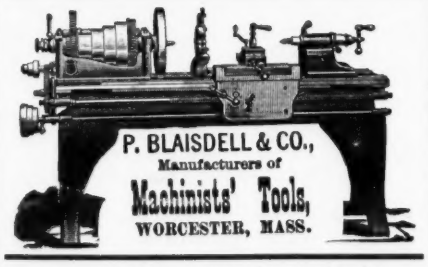
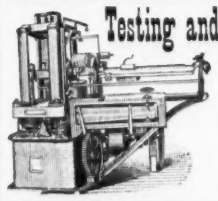


Testing and Hydraulic Machinery,



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Complete Universal Milling Machines.
Plain Back Geared Milling Machines.
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All designed to meet the requirements of the best practice.

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PATENT END GRADUATION.
We Invite Comparison for Accuracy with all others.
EVERY SCALE GUARANTEED. SEND FOR LIST.
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D. SAUNDERS' SONS,

21 ATHERTON ST., Yonkers, N. Y.
MANUFACTURERS OF
Steam & Gas Fitters' Hand Tools.
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Pipe Cutting, THREADING, AND Tapping Machines.

THE PATENT WHEEL PIPE CUTTER shown in the cut combines simplicity with strength and lightness. Easily adapted to various sizes of pipe. Rolling instead of sliding motion. No loose parts to become detached and mislaid. All wearing surfaces are of tool steel hardened. Less friction of parts than any other pipe cutter made.

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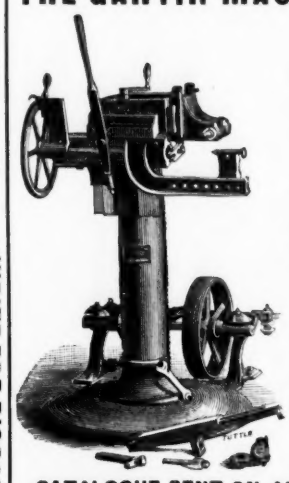

SMALL GEAR CUTTER.
This handy little machine is intended for rapid and convenient cutting of light gears, ratchets, etc., used in telegraphic and mathematical instruments, etc.

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MANUFACTURERS AND DEALERS IN IRON-WORKING MACHINERY.
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Lathes from 10 in. to 20 in. swing. Largest Variety of Drills manufactured in the world.
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For Reducing and Pointing Wire.
ESPECIALLY ADAPTED TO POINTING WIRE RODS AND WIRE FOR DRAWING.
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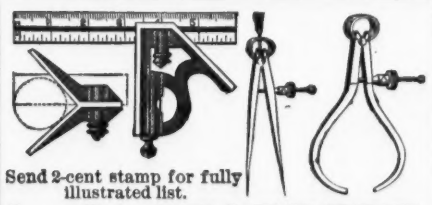
CURTIS & CURTIS,
66 Garden St., Bridgeport, Conn.,
PIPE CUTTING AND THREADING MACHINERY
FOR HAND OR POWER.
Send for Illustrated Catalogue.



Send 2-cent stamp for fully illustrated list.

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BARNES' PATENT UPRIGHT DRILLS.

20 to 42 inch swing, with both worm and lever feed, self-feed and back-geared.

Barnes' Patent Friction Driver. Sensitive Drill. Single and Multiple Spindle.

Barnes' Patent Engine Lathe.
15 inch swing, 6 foot or 8 foot bed.

They have advantages not found in other machines in this line. It will pay parties desiring to purchase or know more about these machines to send for full description and prices to

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METAL PLANERS and SHAPERS

A SPECIALTY.
Send for Descriptive Circulars and Price Lists to
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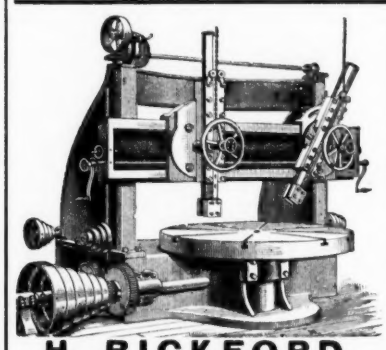
8th & Lock Streets, Cincinnati, O.



BORING AND TURNING MILLS, 4, 5 and 6 Ft. SWING.

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WILLIAM BARKER & CO.,

Manufacturers of
Iron and Brass Working
MACHINERY,
140 & 142 E. SIXTH ST.,
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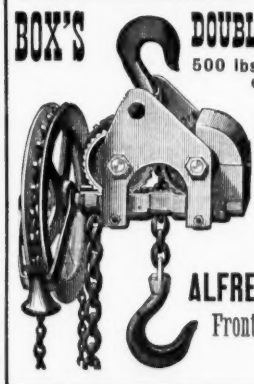
BOX'S **DOUBLE SCREW HOIST,**
500 lbs. to 20 Tons Capacity carried in Stock.



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Photos and Cuts on Application.

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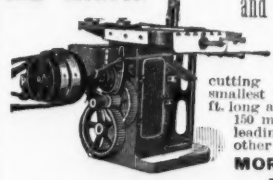
CAUTION

Any Key Seat Cutter with a tool connected to a reciprocating head and made adjustable towards and from the work, and having a vise in which a Key may be fastened in proper position to be cut, infringes claim 8, 9, 16, 17 and 18 of our Morton Patent No. 375,680, of Nov. 22d, 1887.

THE MORTON Lightning Key-Way Cutter and Key Maker,



Portable Key-Way Cutters and Portable Planers a specialty ranging in size and cutting capacity from the smallest work to key-ways 5 ft. long and 6 ins. wide. Over 150 machines in use in the leading shops of this and other countries.

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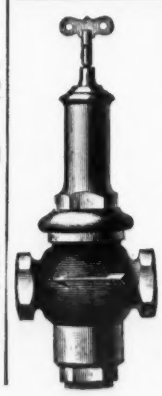
"We have no machine in our works of same cost that earns as much money as yours." EDW. P. ALLIS & CO.
Edwin Reynolds, Supt.



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This Reducing Valve is the
STANDARD
Used by Forty Railroads, and all the Largest Mills, Factories and Steam Plants.

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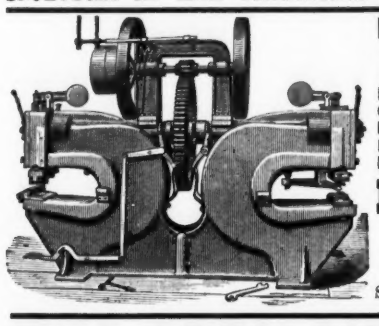
Improved TURNTABLES for LOCOMOTIVES, CARS and PIVOT BRIDGES.
High Speed Power Traveling Cranes and Hand or Power Swing Cranes, Shafting, Pulleys, Hangers, &c., for transmission of power. Improved Self-Adjusting Injector of 1876. Self-Acting Injector of 1887. Fixed-Nozzle Automatic Injector of 1885.
INJECTORS for ALL CONDITIONS of LOCOMOTIVE and STATIONARY SERVICE.



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Double, Single, Angle-Bar, Gang, Horizontal, Twin, Boiler, Spacing, Gate, Multiple, Belt and Steam-Driven
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OVER 300 SIZES.
ALSO
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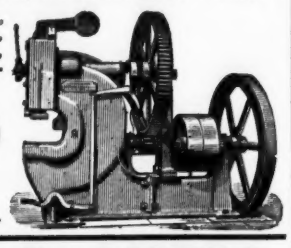
Send for New Catalogue.



THE OPEN SIDE IRON PLANERS.
GUARANTEED
Equal to any Planer of the ordinary style in the performance of standard size work and in
EFFICIENCY, CAPACITY, AND ADAPTABILITY TO EXCEL
ANY OTHER METAL PLANING TOOL
Sizes 30″ to 120″ by any length. Write for prices and detailed information.
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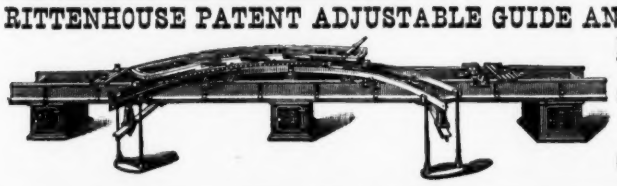

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Or other Structural Iron Workers.
Designed for either **straight** or **curved** work.
Prices and descriptive circular sent upon application.
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ALL KINDS OF TRANSMISSION MACHINERY OF THE HEAVIEST CLASS.
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Substantial, Well Made, Low Priced, Patented,
20 Inch Drills,
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THE INDISPENSABLE LATHE DOG.
DROP FORGED FROM BAR STEEL.
One Set of 3 does the work of 12 common dogs.
No. 1, ¼″ to 1¼″; No. 2, ½″ to 2¼″; No. 3, 1″ to 3¼″.
$7.50 Per Set.
These DOGS can be attached after the work is centered in the Lathe.
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METAL-WORKING MACHINE TOOLS
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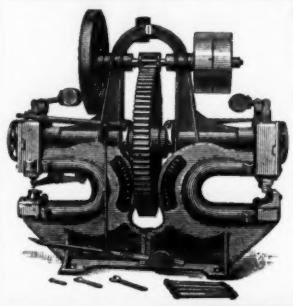

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All Designs and Sizes,
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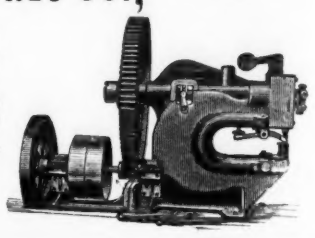
Boiler Makers, Bridge Builders, Ship Builders, Railroad Shops, Locomotive and Car Builders, etc., etc.



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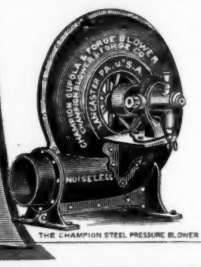

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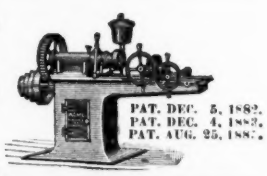

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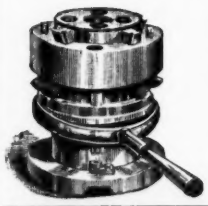

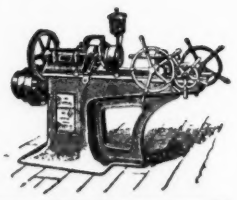

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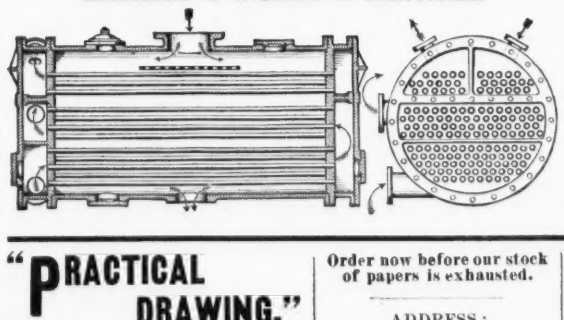

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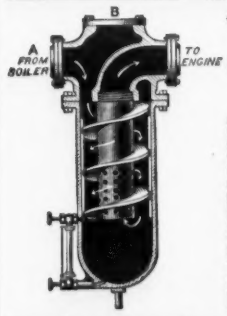

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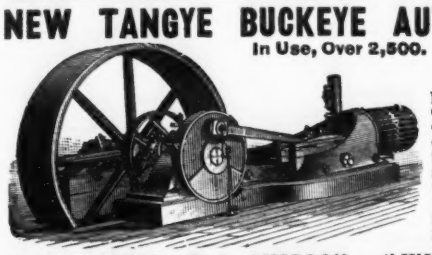

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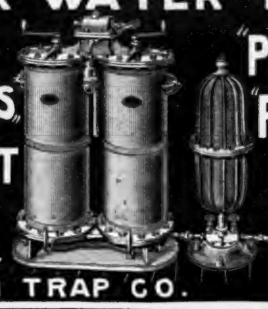

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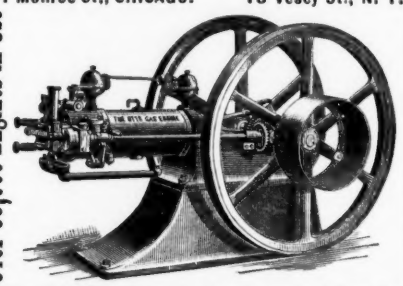

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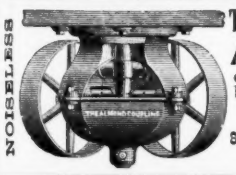

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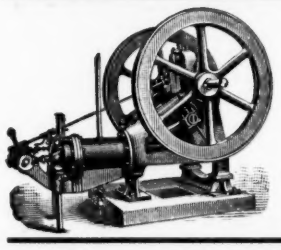

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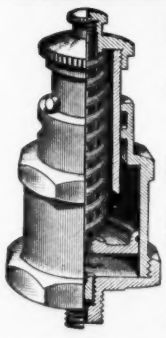

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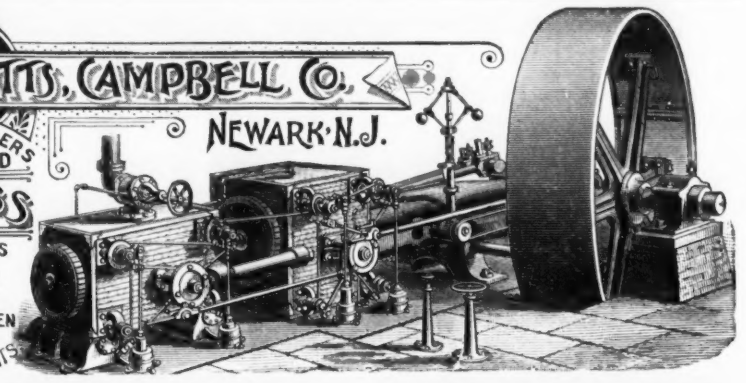

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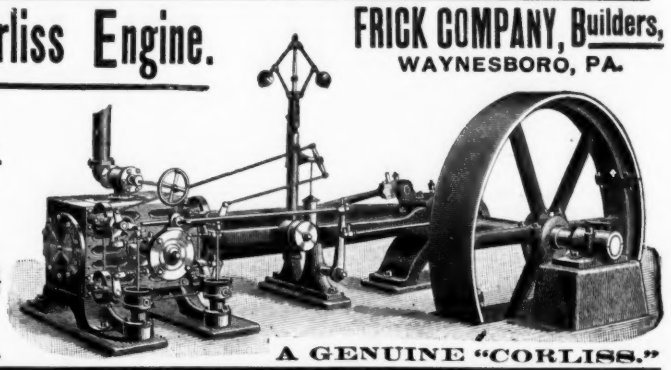

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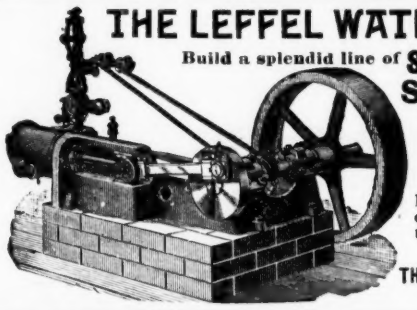

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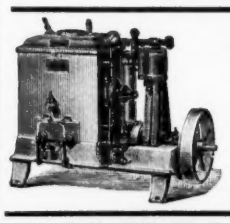

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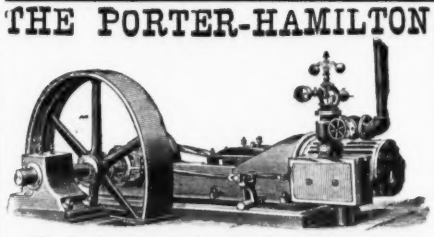

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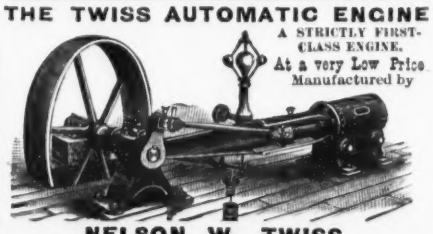

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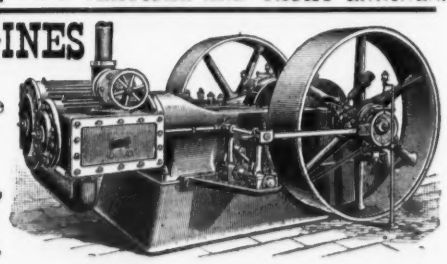

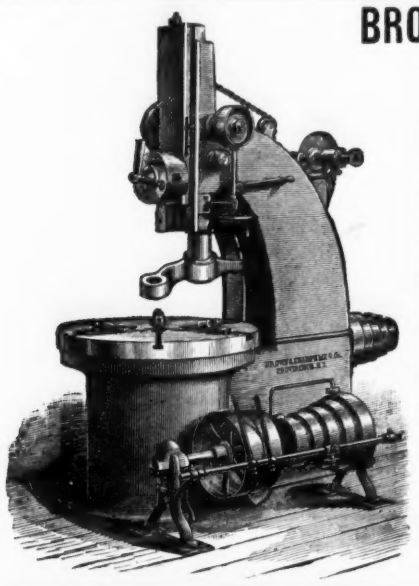

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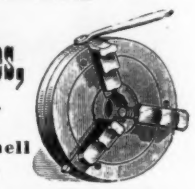

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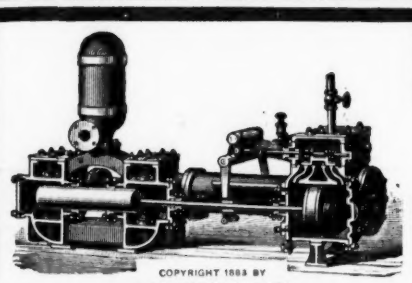

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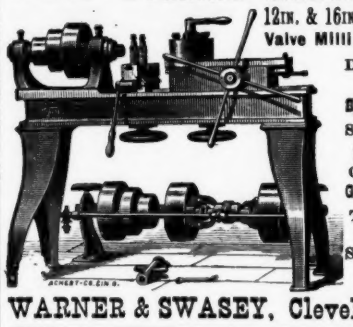

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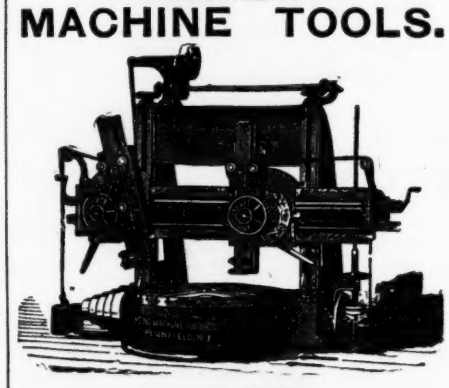

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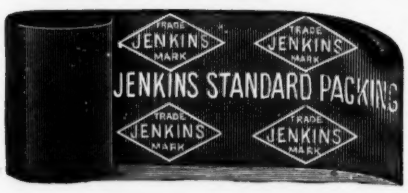

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The Lodge & Davis Machine Tool Co., Works: CINCINNATI, OHIO.

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N. B.—See "Advertisement," page 16.

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A SPECIALTY.

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Lathes, Planers, Drills, or anything in Machinists' Tools or Supplies.

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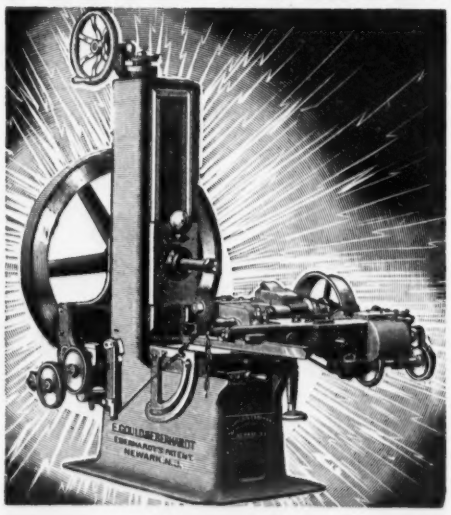
GOULD & EBERHARDT, Newark, N. J.



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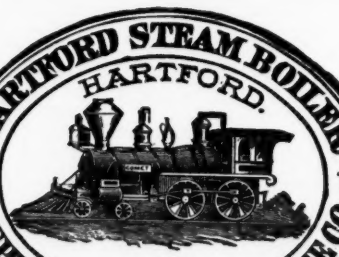

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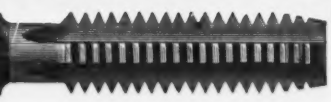

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